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A CROP CHOICE FRAMEWORK FOR A MORE SUSTAINABLE AGRICULTURE
THE CASE OF THE ARGOLID VALLEY IN GREECE

Innovation & Technology Assessment Unit

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A Crop Choice Framework for a more Sustainable Agriculture:
The Case of the Argolid Valley in Greece.

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ABSTRACT

This thesis integrates a number of disciplines from the natural and social sciences to develop a crop choice framework for a "more" sustainable agriculture. The biophysical, socio-political and technoeconomic influences upon farmer's decisions form the central component of the framework with policy makers the intended target. The sustainability of agriculture generates a lot of debate among academic and policy communities. The literature concerning this debate is considered and it is argued that sustainability is site specific and can only be discussed in relative rather than absolute terms.

The research is carried out in three phases each of which contributes to the final framework. The first phase produces a generic framework which is then applied to a particular area, the Argolid Valley in the Peloponnese, Greece. The modified framework is then used to evaluate a specific "crop" (greenhouse roses) and it is demonstrated that the crop will only be adopted by a minority of farmers with particular characteristics. However, it constitutes a useful example for the assessment of whether a crop is promoting sustainability in all its social, economic, ecological and agronomic dimensions.

The thesis provides an overview of the disciplinary components that a crop choice framework should include and the techniques employed to support this. Similarly, by underlining the critical role of the farmer, it aims to produce a conceptual framework which is useful for policy formulation and decision-making.

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SYMBOLS AND ABBREVIATIONS

EC = electrical conductivity in mmhos/cm, unless otherwise specified

mhos/cm	= 1,000 mmhos/cm
mmhos/cm	=1,000 μmos/cm
mS/cm	=mmhos/cm
μS/cm	=μmhos/cm

EC_e = electrical conductivity of saturation paste

Ec_{sw} = electrical conductivity of soil water

Ec_w = electrical conductivity of irrigation water

ppm = parts per million

meq/l = milliequivalents per litre

pH = log hydrogen ion concentration

ET = evapotranspiration

<u>CONVERSION FORMULAE</u>

<u>MEQ/LT</u> = 10 X EC in millimhos/cm

MG/L = 640X EC in millimhos/cm

CHAPTER 1

1. Research context and thesis structure

1.1 Introduction and Summary

The aim of this thesis is to produce a crop choice framework for a more sustainable agriculture. The thesis makes the point that having a good understanding about the physical cultural and economic environment in which farmers make their cropping decisions, and how they perceive that environment, is of critical importance for the policy process (Ilbery, 1985).

Agriculture fulfils a number of functions. It produces food, supports a range of related industrial processes, acts as guardian of the countryside, degrades the environment and underpins rural communities (N.R.C, 1989). These different roles all influence and are influenced by crop decisions and need to be represented in a decision framework which supports a more sustainable agriculture.

The thesis considers existing frameworks for crop choice through a review of the literature. This leads to the development of a generic framework which is divided into three subsystems (biophysical, techno-economic and socio-political) each of which is examined separately and as part of an holistic picture. However, as it is site specific, that sustainability cannot be effectively studied on a general basis alone (Flora, 1992). For this reason the generic framework is applied to a specific area and is amended and expanded for its particular needs. This area selected is the Argolid Valley in the Peloponnese in Southern Greece. The final phase of research tests the framework for a particular crop, the greenhouse rose.

Before discussing and describing the three phases of the research, the meaning of "sustainability and sustainable agriculture" is examined. The debate about sustainability is revised and emphasis is given to what the many definitions of sustainability have in common. This leads to a recognition of the need to adopt a systems approach not only for the purpose of this thesis but in any work dealing with sustainability issues. The thesis deals with agricultural systems and the research carried out is influenced by the "agroecosystems analysis" approach, (Conway, 1985; IJC, Research Advisory Board 1978; Vallentyne and Beeton, 1988). This approach highlights the need to deal with more than one discipline and is identified as one way of avoiding mistakes emerging from adopting a strictly linear "scientific approach" (Grove and Edwards, 1993). The limitations of working in such a way are identified and the need to adopt a multidisciplinary method considered.

The next step is the requirement to move from dealing with more than one discipline when such complex issues are concerned, to the integration of the information provided by these disciplines. It is maintained that the various disciplines are a starting and not an end point for the research. So, it is the drawing of linkages between them and their examination through an interdisciplinary and integrative approach, which is central to this work (Slocombe, 1990).

I. A fundamental point of this thesis is the need to identify all the decision makers involved. Obviously farmers are central actors for the creation of such a framework

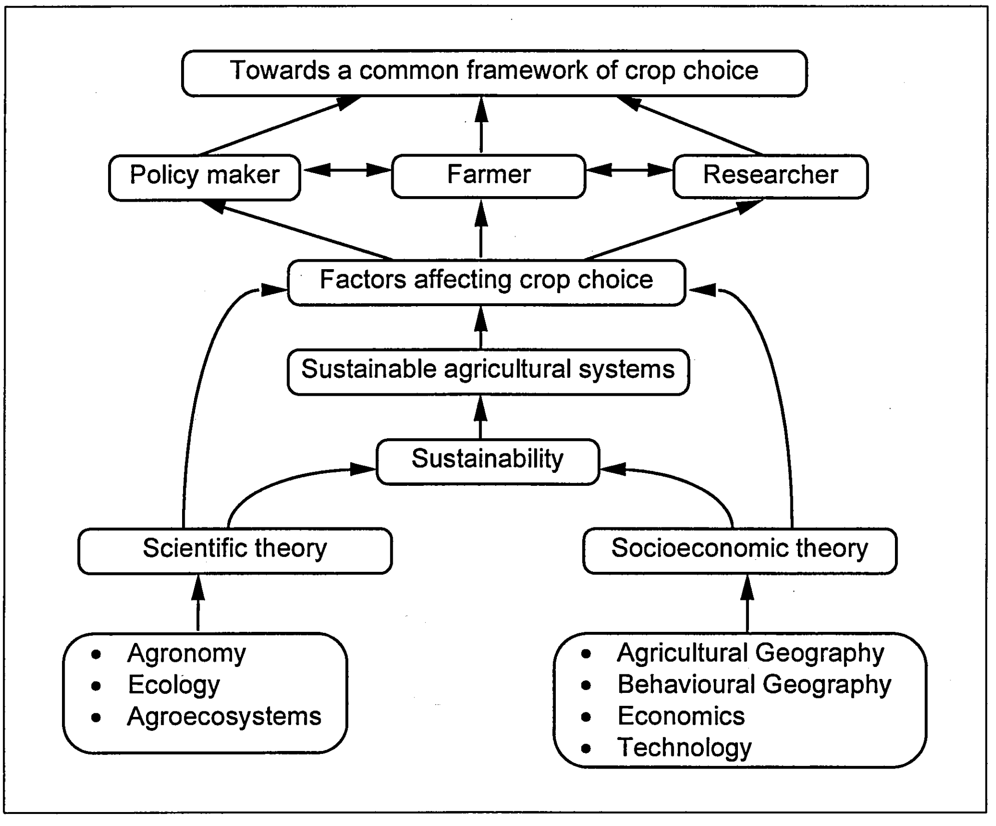

Figure 1.1: Conceptual representation of the framework

(Flora, 1992). The latter underlines the need for an understanding of the literature on farmers' attitudes and behaviour, with more specific insights obtained through interviews and questionnaires in the case study area. Also, an appropriate framework for crop choice cannot be developed, without identifying other key actors related to agricultural production and considering their views about the process, e.g. politicians, public administration, agronomists, research scientists.

A conceptual representation of the framework through the research process and the disciplines involved, is shown in Figure 1.1 and a summary of the research process

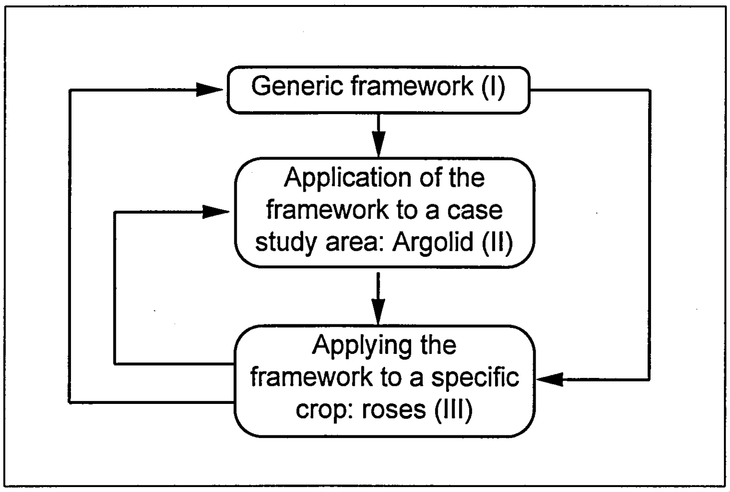

Figure 1.2: The process of creating the three frameworks of the thesis and their interactions

and the research design follows below.

1.2 A summary of the research design and process

The development of the crop choice framework is carried out in three phases. These are represented in Figure 1.2.

1.2.1 First phase

As a first step of this research, an examination of the literature is undertaken. This considers existing frameworks for crop choice, research about the concept of sustainability and information on previous work about how farmers develop their agendas. A synthesis is made to support a generic framework which includes and integrates material from more than one discipline. Emphasis is not given to the disciplines as such, but to the material they can contribute towards the construction of the framework.

The biophysical, techno-economic and socio-political subsystems are examined as individual systems in the generic framework and the linkages between them are examined and applied to a specific area and crop.

1.2.2 Second phase of research

The second step is the application of the generic framework to a particular area (the Argolid valley) in order to test it and amend it. As stated in the introduction, this approach was adjudged necessary because sustainability and a sustainable crop choice are both site specific.

The Argolid valley in Greece is dominated by agriculture and has a recent history of monocropping and degradation of natural resources, i.e. water shortage, salination and vulnerability of crops to pests and diseases. By examining the relative success of this agriculture and its effects on the environmental resources of the area, one may determine what modifications can be made to the generic framework. In this way, the sustainability of the agriculture in the Argolid is discussed and questioned.

This introduces the need for establishing a more sustainable agriculture in the area and is directly linked with the research question to produce a framework for crop choice contributing to a more sustainable agriculture.

It is argued that the issue has been treated up to now by policymakers and research scientists in a purely technical way. They have considered the main problem to be the lack and salinity of water and the solution to lie in bringing water to the area for the maintenance of the established agriculture. This approach, does not take into account other important factors like the long term socio-economic and environmental implications of this agriculture for the area. Similarly, inadequate consideration of the characteristics of decision-making of the various key actors involved and especially of the farmers is identified. The thesis takes these factors into account with emphasis being given to farmers decision-making since they are considered the final recipients of the framework.

The material for this phase was provided from the qualitative analysis of secondary data which were collected between 1992 and 1994 for the Archaeomedes Project[1] into desertification on the Mediterranean. More detailed reference about the purpose of the project can be found in the Section 5.1. Thirty semi-structured interviews and more than 200 questionnaires were undertaken during the two phases of fieldwork for the Archaeomedes project by the researcher. They included data about farm structures and use of natural resources. During the first phase of Archaeomedes semi-structured interviews were preferred instead of structured ones because among other reasons they provide more freedom for the interviewer , they allow more issues to be covered and the interviewee can express him/herself more easily. Although there was a checklist of issues to be raised, the interviewer had freedom regarding how they were raised and pursued. It was judged that this set of data contained relevant information that had not been used for Archaeomedes regarding factors affecting farmers decision making about crop choice, so they were used for the development of the socio-economic and political component of the second framework of the thesis as it can be seen in Chapter 6.

The second set of data collected for Archaeomedes contained structured information regarding farm holdings and water infrastructure. The use of questionnaires was judged as more appropriate in this phase, since the aim was to collect specific information. Part of this material is used in Chapter 5 to support the biophysical component of the second framework of the thesis. So, both sets of data treated as secondary data were used to build the second framework of the thesis.

Finally, farmers decision-making is represented in the form of decision-trees which provide a synthesis of the factors affecting their crop choice as they emerged from the qualitative analysis of the interviews. Decision trees were considered as an appropriate way of representing the framework of this phase and for the next one regarding the choice of a particular crop in the area. (See also Section 6.1). They are not restricted to

[1] ARCHAEOMEDES: Archaeological Mediterranean Desertification. (EV5V-0021).

single attributes or farmers and give a general overview of the decision making process regarding the crop choice in the area for this phase and regarding the choice of a potential crop in the third phase. They have been considered as a more dynamic way of representing the framework by trying to conceptualise the way farmers make their decisions in a particular area and for specific crops.

1.2.3 Third phase of research

The amended framework which was produced from the second phase of research is now applied and tested for a prospective crop. The crop chosen is greenhouse roses. Their suitability is examined from the biophysical and technical, socio-economic and political point of view. Roses were suggested, through a seminar funded by the Greek Ministry of Agriculture, as a possible option for unemployed farmers of the area and this was the reason why they were adopted as the case study of the thesis. Teaching by the researcher in that seminar was one source of information about the suitability of the crop for the particular area and farmers from the biophysical and technical point of view. The socio-economic suitability is also examined through interviews with farmers-owners of greenhouses and other key actors of the area. As in the previous phase, twelve semi-structured interviews were planned and undertaken with owners of greenhouses and specialists. The sample was representative of the total of owners of greenhouses with roses in the Argolid with around three quarters of the total of owners in the area taking part. The intention of the researcher was to tape-record these interviews which would make their analysis easier. This has not been feasible, (see Sections 8.1, 8.3), and the researcher only managed to take notes after the end of the interviews. More details about the design and undertaking of these interviews can be found in the Section 8.3. A further set of more structured interviews (questionnaires) was planned to be undertaken with the students of the seminar. This aimed to collect more structured information about their response to the suggestion of roses and the possibility of adopting the plant as a result of this training scheme. The reasons why this fieldwork exercise was not possible and the constraints faced are explained in Section 8.1. The physical suitability of the crop and its particular requirements are examined from the literature and for local conditions. The modified framework is used in this phase to suggest why a take up of roses might not be possible. The design of the case study of roses and the method used is discussed in detail in section 8.1. The qualitative analysis of the interviews and the use of the conclusions from the teaching contributes to the creation of decision trees, as in the previous phase. It is judged that they give a good picture of how the farmers in the Argolid think and make their decisions regarding roses. They also capture and map the factors which constrain the adoption of roses to a great extent. This finally leads into discussion of which factors should be considered for the successful adoption of suggested crops. The following Section 1.3 gives an outline of the structure of the thesis.

1.3 Thesis structure

• Chapter 1	Introduction, Research process, Research activities, Chapter Layout
• Chapter 2	Sustainable agricultural systems
• Chapter 3	Introduction of the Generic Framework (I) -the Biophysical subsystem
• Chapter 4	Framework I: The socio-economic and political subsystem
• Chapter 5	Framework II : Argolid-the biophysical and technical subsystem
• Chapter 6	Framework II: Argolid- the socio-economic and political subsystem
• Chapter 7	Framework III: Roses -the biophysical and technical subsystem
• Chapter 8	Framework III: Roses: the socio-economic subsystem
• Chapter 9	Discussion, Findings, Conclusions and Recommendations for further research.

Table 1: Outline of the chapters of the thesis

The following Chapter will discuss the debate about sustainability, sustainable agriculture, sustainable agricultural systems and the research approach of the thesis.

Chapter 2

2. Sustainable agricultural systems

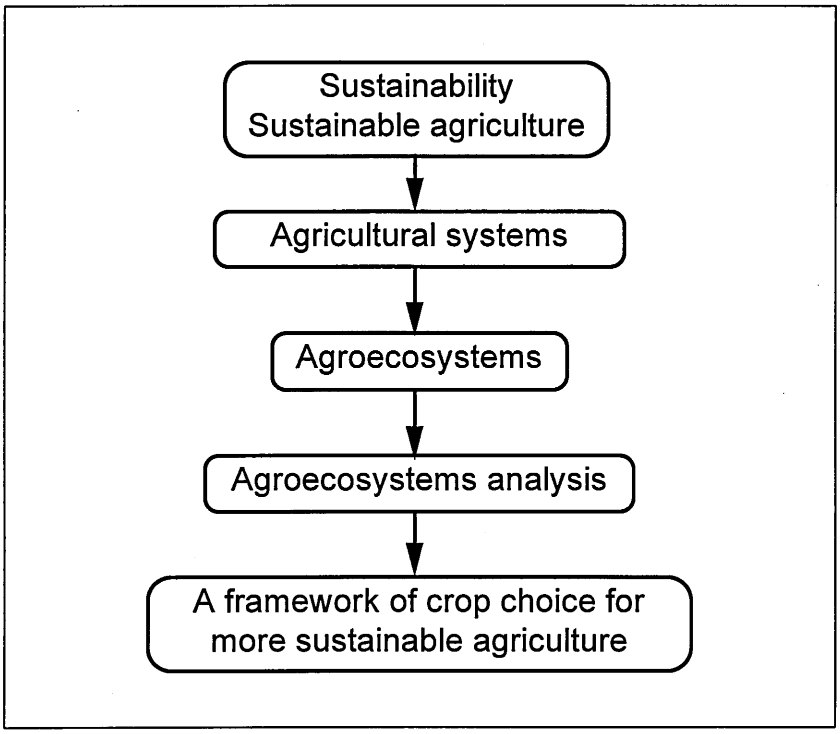

Figure 2.1. The theoretical background of the thesis

2.1 Introduction

This chapter deals with building the theoretical background of the thesis. A conceptual representation of it is represented in Figure 2.1.

This chapter considers the approach adopted for the study and the reasons why a natural scientific perspective is not sufficient for the development of a crop choice framework.

Definitions of sustainability are examined, alongside the historical evolution of the term and concept and the types of research which have emerged out of it. Emphasis is given to the identification of what the many definitions of sustainability have in common rather than trying to redefine the term. Finally, the need to adopt a systems approach for this kind of research is seen to emerge from the debate about sustainable agriculture.

2.2 The sustainability of agriculture: evolution of the concept and definition of the term

Before focusing on the framework for crop choice, there is a need to develop an understanding of the concept of sustainability. In order to do this some critical points need to be covered. They are summarised in Table 2.1.

Sustainability

- what do we want to sustain?
- sustainable for whom?
- sustainable when: short-medium-long term
- sustainability as a site specific term
- adopting a systems approach, away from a strictly scientific paradigm
- moving towards multidisciplinarity, interdisciplinarity transdisciplinarity
- the need for establishing a new paradigm, with each discipline giving some ground.
- need for stopping working towards definition only
- the need for establishing indicators of sustainability
- the need of moving the debate towards measurement

Table 2.1: Critical questions concerning sustainability

What is sustainable in one area, is not necessarily sustainable in another location. That is to say sustainable agriculture is applied uniquely to each site (Lockeretz, 1988; Stenholm and Waggoner, 1990). Similarly, it is important to clarify whether we are concerned about absolute or relative sustainability; it is maintained that it is more feasible to discuss about whether a situation is not sustainable or a more or less sustainable option, in relative and not in absolute terms. There is also a relativity in "sustainability", depending on the time or geographical scales considered (Fresco and Kroonenberg, 1992).

A large part of the debate about sustainable agriculture has so far been concentrated in trying to define the concept. So, the picture obtained from the literature is that we have a very important issue that everybody examines, deals with and tries to implement but despite its importance there is no single definition. Instead, every researcher gives his/her own definition. A point this thesis makes is that there is a need to translate sustainability into practice instead of striving to arrive at a common definition (trying to implement sustainability instead of arguing for its definition). More importantly research should move towards agreeing on the goals and objectives of sustainability, (what we actually try to sustain and for whom).

The science and practice of sustainable agriculture is as old as agriculture, although the contemporary use of the term has evolved more recently (Altieri, 1987). Amongst the pioneers of sustainable agriculture are Franklin King, Lord Northbourne and Lady Eve Balfour (Neher, 1992). In 1911, King published his book *Farmers of forty centuries: permanent agriculture in China, Korea and Japan.* He compared the low-input approach of oriental agriculture with the methods used by the US farmers. He put forward the idea that *"agriculture could not be sustained in the long term in economic, biological or cultural terms unless it was rooted firmly in conservation and recycling of fertiliser elements and organic materials".* Lord Northbourne was the first to use the term "organic farming" in his book *Look to the land*, published in 1940. The phrase "sustainable agriculture" was not used until the late 1970s when it was coined by Lady Eve Balfour (Rodale, 1990). According to Edwards, (Edwards et al, 1993), the development of the concept of sustainable agriculture which is *"a relatively recent response to concerns about degradation of natural resources"* was first articulated by Jackson (1980) and by Rodale (1983).

An important step towards defining the concept of agricultural sustainabilty came with the Brundland Report (World Commission on Environment and Development, 1987). The Commission emphasised the need to determine the concepts of sustainability and sustainable development and their relevance to socio-economic development and environmental conservation.

The report stressed the role of environmental degradation as an obstacle to agricultural and overall economic development. It argued that sustainability implies that *"economic activity should meet current needs without foreclosing future options".*

So, in about 1987, the phrase sustainable agriculture took an additional meaning. As more and more groups and organisations began to recognise the need for adjustments to conventional agriculture that are environmentally, socially and economically compatible, *"the phrase sustainable agriculture was used to connote a global agriculture that could provide for the needs of current and future generations while conserving natural resources "* (Douglass, 1984). Sustainable agriculture has emerged as the term which most readily synthesises a variety of concepts and perspectives associated with agricultural practices that differ from those associated with conventional production agriculture.

Low input or resource efficient agriculture focuses on the resource dynamics of the agroecosystem (Conway, 1985; Harwood, 1987). Other perspectives emphasise the social and ecological aspects e.g. agroecology (Altieri, 1987), a specific set of practices e.g. organic farming (Lockeretz, 1988) or management concepts combined with an ecological/social overview e.g. biodynamics and permaculture (Hauptli et al., 1990).

The definition of sustainable agriculture adopted by the American society of Agronomy is one that *"over the long term enhances environmental quality and the resource base on which agriculture depends, provides for basic human food and fibre needs, is economically viable and enhances the quality of life for farmers and society as a whole"* (Schaller 1990).

According to Altieri (1987), *"sustainability/ refers to the ability of an agroecosystem to maintain production through time in the face of long term ecological constraints and socio-economic pressures".*

Flora, comments that *"sustainable agriculture is as much a process as an end point"* (Flora, 1992). More than a series of techniques, it can be viewed as an approach to agriculture that attempts to find a balance among agronomic, environmental, economic and social optima, based on the following definition provided by Francis and Youngberg (1990):

"Sustainable agriculture is a philosophy based on human goals and on understanding the long-term impact of our activities on the environment and on the other species. Use of this philosophy guides our application of prior experience and the latest

scientific advances to create integrated, resource conserving, equitable farming systems. These systems reduce environmental degradation, maintain agricultural productivity, promote economic viability in both the short and the long term, and maintain stable rural communities and quality of life

So, sustainable agriculture as a philosophy, integrates stewardship with agriculture. Stewardship implies that land is managed with respect for use by future generations. All the definitions of sustainability, however have some common themes and identifying them is more feasible than finding the most appropriate definition. Three common themes have been identified as occurring in definitions of sustainable agriculture:

- Plant and animal productivity
- Environmental quality and ecological soundness
- Socio-economic viability

As has already been discussed another common point in the debate about sustainable agriculture is that it is site specific, and therefore needs to be applied uniquely to each site (Neher, 1992) and must be tailored to specific regions, soil types, topography and climate (Lockeretz, 1988).

2.3 Science-led versus socio-environmental paradigm

This debate gave birth to a new paradigm which contrasted to the science-led developmental paradigm on which most developmental programmes relied after the Second World War (Grove and Edwards, 1993). The science-led developmental paradigm gave birth to an industrial model of agriculture which *"treats the farm like a factory with inputs and outputs and considers fields and animals to be production units"* (Kirschenmann, 1991). This adopts a reductionist approach and has a Malthusian perception of agriculture in which human carrying capacity is determined by food availability. The latter restricts therefore the role of agriculture in producing increased amounts of food to feed the globe.

However, after the success of the Green Revolution different types of concern (environmental and economic) started to appear (Grove and Edwards, 1993). Until the late 1970s, little attention was given by environmentalists to agriculture since all their emphasis was concentrated in wildland preservation, urban-industrial sources of pollution, environmental degradation. *Silent Spring*, the book by R. Carson (1963) which gave raise to a lot of debate was not an exception. The need for a sustainable agriculture was underlined at first by a few groups and organisations such as the Rodale Institute in the United States. However, sustainable agriculture developed rapidly as a symbol and as a concrete program of research because of the growing environmental movement in American society which itself was strongly anchored *"in international environmental mobilisation efforts focused on global warming, global environmental change, and loss of biodiversity"* (Buttel, 1993).

Agriculture started getting environmental attention during the 1970s and early 1980s. The early and mid-1980s were characterised by a farm crisis with high debts, low commodity prices and overproduction. The research into sustainable agriculture which developed under these conditions became a synonym for low-chemical input agriculture. This was largely because of the poor state of farm credit and low chemical input agriculture which was adopted because it was less capital intensive. This low chemical input research led the way for the introduction of the Conservation Reserve Program of the 1985 Farm Bill and the USDA Low-Input Sustainable Agriculture (LISA) program.

Emphasis was given by scientists working on development on the limitations of the science-led paradigm (Chambers, 1983; Conway and Barbier, 1990; National Research Council, 1991). This research gave birth to the "socio-ecological paradigm. The main difference between the socio-ecological paradigm and the science-led one is in the assumption that *"the role of agriculture is a means of rural livelihood"* (Groves et al, 1993). This contrasts with the science-led developmental approach which assumes that the role of agriculture is to feed the globe. In this paradigm the role of rural people in the design and implementation of projects which affect their lives is critical (Altieri, 1987; Chambers 1983).

Success within this paradigm does not have a single indicator i.e. yield or income per unit of land, rather it is measured as an improvement in livelihood. Sustainable agriculture and the socio-ecological paradigm which emerged out of it, avoids maximising any single outcome variable, whether it be environmental quality, economic return, yield per acre or number of family farms. It seeks a balance of environmental conservation, agricultural production, farm profit and community well being (Flora, 1992). So, working within this context means working towards synthesis and integration and away from reductionism.

2.4 Interdisciplinary research

Two more common points in the research towards a sustainable agriculture are that because of the complexity of the issue, it deals with more than one discipline and it raises the need to adopt a systems approach. In the literature, it is almost regarded as a matter of course that sustainable agriculture research is multidisciplinary (Lockeretz, 1991; Park and Seaton, 1995).

Sustainable agriculture by definition includes more than one goal since it tries to find a balance among agronomic, environmental, economic and social optimums (Flora, 1992). For these goals to be satisfactorily explored and finally achieved, there is the need for teams of scientists to work on it so that no goal is maximised against the others.

The need for reliance on multidisciplinary, interdisciplinary or transdisciplinary teams in research is clearly stated in the literature regarding research towards sustainable agriculture (Flora, 1990). Lockeretz (1991), identifies four types of multidisciplinarity depending on the degree that the component disciplines interact:

1. Additive: where *"people from different disciplines simply co-ordinate their studies of the same topic, with each concentrating on one aspect of it "*.
2. Integrated: where the topic is also divided into disciplinary components , *"with emphasis given in the linkages between them and to questions that either overlap or fall between different discipline domains"*.
3. Nondisciplinary : where disciplines are ignored completely, at first at least. This happens when *"the topic does not come close to being dividable along disciplinary boundaries"*.

4. Synthetic: where old disciplines disappear to be replaced by new ones as a result of the emergence of *"new concepts or theories that were not foreseeable in the precursor disciplines"*.

Of these, the integrated approach is closest to the type of research undertaken for this thesis.

2.5 A holistic systems approach-Agricultural systems- Agroecosystems

Next, the meaning of a *"holistic- systems approach"*, a term which is also widely used in the literature, will be examined. The concept of wholeness and the ideas of holistic thought are not new. By "wholeness" is understood the characteristics of things or systems that display *"qualitatively distinct and autonomous behaviour with respect to their constituent parts"* (Klaus and Buhr, 1976). Wholeness is a qualitative definition and it is not to be confused with totality which is a quantitative composition made up of a certain number of elements or parts (Glaeser, 1988).This distinction belongs to Aristotle, who separated *holon* (whole) and *pan* (totality). So, what Aristotle said about *"the whole which is more than the sum of its parts"* must be understood qualitatively and not quantitevely. The meaning is that the relationship between the parts cannot be derived from the laws which apply to the individual parts but only from the whole.

In addition to this cross-system interrelations cannot be extrapolated and interpreted from partial areas. The opposite is true: only when a system's coherence is fully understood can partial areas be classified and hence known. Though the term "system" is used in everyday life, a definition is necessary. Spedding (1979), defines a system as: *" a group of interacting components, operating together for a common purpose, capable of reacting as a whole to external stimuli: it is unaffected directly by its own outputs and has a specified boundary based on the inclusion of all significant feedback"*.

The living world is conceived as an hierarchy of such systems (organism-population-community-ecosystem-biome-biosphere) each with distinctive boundaries and distinctive system behaviour. Another characteristic of systems is that they present hierarchical behaviour: e.g. field-farm-village-watershed-region (Lowrance et al., 1986).

Agricultural systems are considered as agroecosystems (Conway, 1985, 1987) and by definition, an ecosystem is a unit composed of associated communities of organisms and their physical/ chemical environment. By intention people represent one of the communities in agroecosystems and are not external in agroecosystems functions (Neher, 1992, Ikerd, 1993).

The first step in a systems approach is to bound and define the system of interest (Slocombe, 1990). This is then broken into distinct subsystems which can be examined as systems in their own right: i.e. physical/natural or biophysical, socio-political, techno-economic.

This is easier when dealing with biophysical systems where the boundaries are clearly established. However, this is not the case when a socio-economic system is under examination and one has to deal for example, with farmers making their income from sources outside farming, selling their products to markets outside the area of study or when their behaviour is affected by cultural or religious beliefs.

The next step is to define the system properties or system attributes and to find ways of measuring or quantifying them. Quantification and measurement of sustainability is currently, a major issue in the debate on sustainable agriculture. It seems that it has taken the place of definition in the debate on sustainability.

Various system attributes or properties have been suggested (Dalsgaard, 1995; Fresco and Kroonenberg, 1992; Conway, 1985) and this thesis broadly adopts the following properties suggested by Conway: productivity, stability, sustainability, equitability. Sustainability in this case is considered as *"the ability of a system to maintain productivity in spite of a major disturbance such as caused by intensive stress or large perturbation"*.

The debate about sustainability is currently shifting from arguing and working towards the definition of the concept to the definition, establishment and measurement of indicators of sustainability (Gliessman, 1990). This brings the debate onto a more practical action ground. To achieve this however, there is a need to establish concrete targets first and then work and decide what an indicator of sustainability is.

Discussion about indicators of agricultural sustainability, can be focused in a cite specific level. This way, the targets for the concrete agriculture are first established and then representative, broadly acceptable and measurable indicators are identified.

2.6 The role of the farmer in this research

According to Conway, *"the farmers from necessity adopt a multidisciplinary, holistic approach to their work and it would seem logical that this should apply to agricultural research and development programmes"* (Conway, 1985).
There is an absolute need for farmers' participation, as equal members of research teams. Several reasons can be given for this are:

- that rural people have the right to decide on programs which directly affect their livelihood (Chambers, 1983; Altieri, 1987; Clay, 1988).
- that local people have an indigenous knowledge which makes a precious contribution to the research; sustainable farming systems are knowledge-based systems of farming (Ikerd, 1993). Knowledge will be the key to economic and political power in the future (Toffler, 1990) and the farmers with their own practical knowledge have a contribution to make.
- the sustainable model implies greater reliance on human resources, in terms of quality and quantity of labour and management and relatively less reliance on land and capital (Ikered, 1993).
- because the farm family embodies the complexity of multiple goals at the microlevel; while the experts advocate macro-level goals such as environmental conservation and enhancement, high productivity, maintenance of farm families on the land and development of viable communities (Flora, 1992).
- the need for knowing the multiple goals held by the people implies that research is undertaken to identify and recognise these goals (Grove and Edwards, 1993).
- farmers have produced many innovations, *"before they were the subject of formal agricultural research."* One example of this is organic farming.

If working in an interdisciplinary manner is important to achieve agricultural sustainability goals the research needs to adopt an holistic systems approach in the research, seems to be the only appropriate way to achieve it (Neher, 1992).
Returning to the holistic approach that the socio-ecological paradigm adopts, one can say that it deals with a broad range of the farmers' livelihood needs and the activities and infrastructures that support them. The approach is broadened to include the whole farm, employment and external markets, health and social needs. Far from giving emphasis to the components themselves, this approach is concerned more with the processes and the linkages between the components. Great emphasis is given through this paradigm to people who are the objects of development and is found in many works which adopt the socio-ecological approach (National Research Council, 1989, 1991).
In conclusion, two critical points arise as a result of this revision of the debate on sustainability:

- Successful research needs to be interdisciplinary and integrative.
- One cannot discuss realistically a framework for sustainable agriculture without considering the actors involved and how they make their decisions. Therefore, a thorough examination of the farmers' agenda is considered essential since they are expected to be the final recipients of any change introduced through a framework.

Also, it is considered necessary to bear in mind to whom this framework is addressed, before working towards its creation. This thesis aims to produce a useful tool for the policy-maker, who is responsible for influencing and implementing any change of crops leading to a more sustainable agriculture. It is judged that for the policy-maker to make realistic suggestions, he needs to have a good understanding of the basis of farming decisions and behaviour.
This thesis, tries to show how fruitful policy-relevant research in this context can be undertaken. The next chapter will introduce the biophysical part of a generic framework for crop choice.

Chapter 3

3. Towards a generic framework for crop choice - The Biophysical subsystem

3.1 Introduction

This chapter and the following one deal with the creation of the generic framework of the thesis. As was mentioned in Chapter 1, this is the first of the three frameworks which compose this thesis. In particular, this chapter deals with the creation of the biophysical component or subsystem of the framework. The factors included are those which have been identified from the literature and considered essential for a crop choice framework.

3.2 The biophysical subsystem

When assessing crop choice, the subsystem which is usually considered first is the biophysical one. The natural conditions of an area and the biophysical particularities and constraints are essential factors. So, the thesis will start by considering these factors first. However, problems start to arise if they are the only factors examined. Agriculture has a direct impact on the environment and it is taken for granted that it can degrade the environment by using non renewable resources i.e. soil or water and by creating wastes (N.R.C, 1989). A framework for crop choice, if used, will have a direct impact on the environment. For this reason it is important that possible environmental impacts are considered from the beginning. These depend on the state and the availability of the natural resources of the area under consideration and careful planning for their sustainable use is required. In this case, planning cannot be sustainable if it allows for the short term only by targeting short term profits which very often have detrimental effects for the long term sustainability of the area.

For the creation of the biophysical subsystem a literature review was undertaken and was combined with information from the ECOCROP database of FAO[1].
An examination of the factors which were finally chosen, follows below.

3.2.1 Type of crop production system

Knowledge of the type of crop production i.e. Mediterranean, provides an insight into the kind of agriculture which is currently practised in the area under examination and what might constitute a problem there.
Krantz (1974) defines farming systems as *"the entire complex of development, management and allocation of resources as well as decisions and activities which, within an operational farm unit or a combination of such units results in agricultural production and the processing and marketing of the products"*. According to Thorne and Thorne (1979), the types of crop production systems around the world belong to the following general categories:

- Crop production systems in Humid Cool Temperate Zones
- In Arid and Semiarid Warm Temperate and Mediterranean Zones
- In the Tropics.

This division is primarily based upon climatic distinctions. Another widely adopted classification (especially by geographers) is that of Whittlesey (1936). The aim of this work was *"to classify the agricultural regions of the world into systems of the same order of magnitude by using a uniform scale of delimiting criteria, which facilitated the comparative studies of the different agricultural systems of the world"*.(Singh and Dhillon, 1984).
Whittlesey's classification considers that the regional patterns of agriculture are determined by the interaction of two sets of variables: the physical and the non physical. Different combinations of these produces a range of agricultural landscapes with differing performance characteristics. The criteria of Whittlesey which seem to appear in each classification of agriculture today, are:
1. The crop and livestock combination or the structural character of the system

[1] FAO: Food and Agricultural Organisation.

2. The methods or techniques used to grow crops and livestock.
3. The intensiveness in the application of inputs (labour, capital and organisation) to land and the resultant quantity of output.
4. The disposal of the agricultural produce or livestock products-whether used for subsistence or sold off. i.e. their destination.
5. The ensemble of structures used to house the operations or farm buildings.
Anderson (1970) recognises a four-level frame for the classification of agricultural systems. They are based on the classification by Whittlesey except from the collective farming. Singh and Dhillon (1984), recognise these four levels and add an extra one: the cash-cropping system.
As soon as the type of cropping system practised in the area under consideration is identified, the next step is the consideration of the climate:

3.2.2 The climate

The climate is a basic factor for determining the suitability of a land for agriculture and the suitability of a crop for a specific area. Five major zones are identified by most of the agriculturally oriented classifications of climate (Meigs 1953; Troll 1965, Thorne and Thorne 1979). These are the Polar and Subpolar, the Cold Temperate Boreal (northern), the Cool Temperate, the Warm Temperate Subtropical and the Tropical. The basic components of the climate for plant growth are temperature, precipitation and light.

3.2.2.1 Temperature

The major climatic zones of the world have been defined by temperature differences. The type of temperatures that are usually considered are the average maximum and average minimum temperatures. However, when considering appropriate crops for an area absolute temperatures should be examined as well and especially the frost-free season because it determines the crops that could be successfully grown. So, one critical factor for deciding about the suitability of a crop, is the frost-free days, data on minimum, maximum and optimum temperatures of the area under consideration and their distributions.

3.2.2.2 Rainfall

Rainfall is a major climatic factor which influences the potential of any species. The amounts that are usually considered are the total amount of rainfall per year, or within the growing season, the minimum annual rainfall and the maximum annual rainfall. However, there are factors which are much more important and critical and need to be considered. These are:

- seasonal distribution of rainfall
- variability
- rainfall effectiveness
- reliability within and between the seasons.
- intensity
- rate of infiltration into the soil
- the soil ability to retain water
- the balance between rainfall and evapotranspiration.

Distribution, reliability and intensity are crucial factors related to the rainfall. The annual distribution of rainfall is very important to assess a successful crop production. What is essential is that rainfall is spread and received when it is required. An understanding of rainspells and dry or drought spells and their distributions may also be important in case that they are not isolated events but prolonged ones. Their consideration may help farmers as well as authorities in planning various irrigation schemes. No effective assessment of rainfall can be undertaken without consideration of its variability from season to season and from year to year. In the absence of irrigation or a purely dry farming excessive variability can be really disastrous for the agriculture of an area. Rainfall effectiveness is expressed as the actual total rainfall minus the total possible evaporation (Monkhouse and Wilkinson, 1967). It is important that concentration, intensity and reliability of rainfall and evapotranspiration are examined.

3.2.2.3 Potential evapotranspiration

According to a report prepared by the Committee of the American Society of Civil Engineers (Jensen, 1973), potential evapotranspiration is one of the terms about which there is confusion regarding the use of water. Other terms are consumptive use, transpiration, total requirements, steam-flow depletion, irrigation requirements. Such terms are usually interchanged.

Potential evapotranspiration is defined in the same report, as *"the rate at which water if available would be removed from the soil and plant surface expressed as the rate of latent heat transfer per square centimetre or depth of water"* (Jensen 1973).

Evapotranspiration has two components:

evaporation, which is the physical process by which moisture is lost directly into the atmosphere from water surfaces and the soil due to the effects of the air's movement and the sun's heat. Transpiration is a biological process by which water is lost from a plant through the stomata in its leaves. Evaporation rates are affected by temperature, wind speed, humidity, hours of sunshine and other climatic factors (Waugh, 1995).

A major problem is that ET can not be measured directly as temperature and precipitation can.

Thorntwaite (1944) first popularised the idea of evapotranspiration as an expression of the fundamental *energy balance concept.* The weakness of the concept is that because of the complexities of natural surfaces , it is difficult to apply it to specific cases (Thornthwaite and Hare, 1965).

He applied one empirical method of calculation of PE which is supported with lysimetric experiments.

PE needs to be calculated for the specific climatic conditions of an area. In case that suitable experimental values of PE are available, "the validity of the selected procedure should be checked indirectly with the help of irrigation need of water or some indices of climate such as type and nature of vegetation"(Singh and Dhillon, 1984).

3.2.2.4 Light and daylength

Light (sunlight), is a factor of great physiological importance because it helps the formation of chlorophyll and accelerates the process of photosynthesis. Two aspects of light are important for the growth of plants: the effect of clouds in decreasing light intensity, the effects of latitude on the angle of incidence of the sun's rays and on differences in length of daylight. There is a considerable variety of yields depending on whether the light is bright and the skies are clear or they are cloudy with heavy shade. The second factor, day length varies with latitude and season. The dividing point between short length and long length plants is taken to be 12 to 14 hours. Three categories of plants depending on their photo period sensitivity, are recognised in the ECOCROP database- Long day: more than 14 hours, Short day (less than 12 hours), Day neutral: 12-14 hours or not photo-period sensitive.

3.2.3 Soils

The factors which need to be considered regarding the soil of an area and whether it is appropriate for a crop or not are:

- soil texture
- soil depth
- soil drainage
- soil pH
- soil salinity
- soil fertility

The type of soil determines the success or failure of crop production in large part. Soil texture is one of its more important physical properties of a soil. It refers to the relative proportion of sand, silt and clay in the soil and influences porosity, structure, consistency and adhesion. The water holding capacity of a soil is directly linked with its texture: soils which have basically small particles (clay) have better water and

nutrients holding capacity than soils where large particles dominate. The United States Department of Agriculture has set up standard definitions of soil-texture classes and grades (USDA, 1951).
Soil depth is another factor influencing the success or failure of a crop. Most of the water and nutrients used by the plant come from the part of the soil that the roots are in direct contact with. So plants with different root depth respond differently at different soil depths, Shallow (20-50 cm), Medium (50-150 cm), Deep (more than 150 cm).

3.2.3.1 Soil drainage

Irrigation, on one hand degrades the quality of the water for its later users and on the other can lead to an increased soil salinity. This can happen naturally but it can also be accelerated through irrigation with increased amounts of water. The reason for this is because all irrigation water contain dissolved salts which are left behind when the water evaporates from the soil surface or after being taken by the plants, it returns to the atmosphere. (Brady, 1974; NRC, 1989). In areas where less natural leaching occurs, e.g. in semi-arid and arid areas irrigation can create dramatic changes often requiring drainage. This way it is possible to maintain agriculture through reduced concentration of dissolved salts in the root zone. Very often when planning an irrigation system, there is no consideration about disposing or treating of its waste waters. The main consequence of this is a short-lived irrigated agriculture. (NRC, 1989).

3.2.3.2 Influence of slope

Slope is an important physiographic aspect which affects the agricultural land use of an area critically. However, though slope can influence the cultivation pattern very much, there are not usually data about its significance in various areas. This does not mean that when considering appropriate crops for an area one would not consider seriously the existing type of slope. Slope affects the machinery which can be used in an area, the livestock grazing and the accessibility of an area (Asthana, 1968). Similarly, it can make a significant contribution to soil erosion. On sloping land water flows down before being absorbed in the ground. Also, the percentage of precipitation lost by run-off increases accordingly It has been proved experimentally that there is a direct link between the degree of slope and erosion per unit of land (Kohnke and Bertrand, 1959). Finally, irrigation is not as efficient in sloping areas as it is in flat land. Where there are steep slopes good results cannot be obtained unless special measures are adopted, e.g. terracing and levelling the fields with the construction of retaining walls (Cantor, 1967).

3.2.3.4 Soil pH-salinity problem evaluation

Soil reaction or soil pH is another important characteristic of soil quality. It has a direct effect on micro-biological activities and determines the uptake of various nutrients by the plant. It is also important in various phases of soil development. The level of pH (soil acidity and alkalinity) can effect crop growth and therefore needs to be considered within crop choice.

Another important factor on crop choice is the level of salinity and whether this constitutes a problem. Salinity is measured from the electrical conductivity of the irrigation water (Ecw) and is recorded in millimhos per centimetre (mmhos/cm). Three indicative levels of soil water salinity (Ecw) are: < 0.75 mmhos/cm (no problem), 0.75-3.0 (increasing problem), >3.0 severe problem. The relationship between soil salinity and water salinity recorded as saturation extract (Ece) is calculated as half of the salinity of the soil water (ECsw x 0.5=ECe) (Ayers and Westcot, 1976).

Soil salinity is a critical factor for the success of a cultivation. Each increase in soil salinity (Ece) in excess of the concentration that initially begins to affect yield causes a proportionate decrease in yield (Maas and Hoffman, 1976). Cultivations are not successful in saline soils unless the salt is flushed out with large quantities of irrigation water. In such soils it is very important to select crops which present high salt tolerance(Maas and Hoffman, 1976; Bernstein, 1964; University of California Committee of Consultants, 1974).

3.2.5 Irrigation water, quality and availability

The availability of water resources for irrigation is a significant factor in crop choice. Information about this should include:

- Water requirements of the crops under consideration.
- Source, quantity and quality of water available in the area. Knowing the source of water helps in the understanding of whether its quantity will fluctuate and whether water is available at certain periods (i.e. seasonal rainfall) or continuously. The quantity and quality of water can then give an indication of whether there is a potential for high crop yields which in its turn can justify the use of fertilisers and other inputs. In particular the quantity of water can determine the irrigation system selected e.g. sprinklers or drip irrigation instead of flood system in cases of water shortage (Thorne and Thorne, 1974). Similarly, the quality of water infers how well a water supply fulfils the needs of the intended user and it should be evaluated on the basis of its suitability for that use (Ayers and Westcot, 1976). Quality depends greatly on the content of silt and salts. Careful monitoring of total concentrations and the proportion of sodium to other ions and of the presence of various toxic ions, e.g. chloride, borate, sodium, bicarbonate, is important. The most widely adopted classification system is the one adopted by the US salinity Laboratory staff (Richards, 1954; Ayers and Westcot, 1976). ECOCROP, (FAO) also adopts this classification system. One way of avoiding the damage from salt concentration is through good drainage (see soils section above) and another is through the periodic application of excess irrigation water to leach excess salts from below the crop root zone and preferably the soil (Thorne and Thorne, 1974). In addition to salinity, the use of poor quality irrigation water can cause permeability or toxicity problems.

Therefore, the quality of the existing water determines the crops that could be grown in an area. For instance, if the water quality problem for an area is salinity, one should look for crops which tolerate salts and consider the levels of existing salinity and the percentage reduction in yield (Maas and Hoffman, 1976; Bernstein, 1964).

Other factors which have to be examined are:

- An historical examination of the water resources of the area can give a good idea about the frequency and duration of water turns, periods of serious shortage and can help in the anticipation of future situations.
- Mapping the water resources of the area as a whole (in the aquifers), local water sources in the system under examination and that which is available from outside.
- Irrigation technology and existing irrigation systems. A consideration of the particular water conditions of an area will show whether the adopted irrigation method is suitable. Not every method is appropriate. For example sprinklers or drip irrigation would be preferred over a surface method of irrigation (flood, basin, strip-check, furrow etc.). Similarly, drip (trickle) irrigation is preferable to sprinklers when the water contains various salts which can affect the foliage with the sprinklers system spreading the salts over the leaf surface of the crops.
- Areas which need drainage to avoid water logging and or salinity need to be identified.
- Estimates are necessary about precipitation levels. This is particularly important in areas where, evapotranspiration exceeds precipitation (i.e. semi-arid lands); where there is seasonal shortage of water (Mediterranean climate); or where the amount of rainfall is unreliable (i.e. Sahel countries), (Waugh 1995).

- Type of agriculture for which the irrigation is needed is important: i.e. commercial and subsistence farming have different requirements. This will justify the type of technology which can be used and the level of investment to be undertaken.

In conclusion, the factors which were considered as necessary for the biophysical subsystem of the framework and were examined above, are:

- The type of crop production system under examination.

- Climate
- Temperature
- Rainfall
- Light
- Daylength
- Slope
- Soil texture, depth, drainage, pH, salinity
- Water quality and availability for irrigation

The following chapter will deal with the technoeconomic and socio-political subsystem of the generic framework.

Chapter 4

4. The socio-economic and political subsystem

4.1 Introduction and summary

This chapter deals with the socio-economic and political part of the generic framework of the thesis. A thorough examination of the literature provided the attributes which were finally selected and are examined in the following sections. While the biophysical subsystem is of primary importance when a framework for crop choice is discussed, it should not be the only part examined. The reason for this is that lack of careful consideration about the socio-economic and political components of crop choice may have serious implications for the take up of suggested crops. The socio-economic subsystem which is examined here, has three further components: the cultural, the techno-economic and the political. The disciplinary components from which the selected attributes are derived are:
technical, socio-economic, geographical (agricultural and behavioural) and anthropological. Priority is given to the creation of the framework and the disciplines are integrated to this end.

4.2 Social attributes of agriculture

4.2.1 Farm fragmentation

Farm fragmentation is defined as *"the spatial scattering of farm holdings into many non contiguous plots"* (R. King and S. Burton, 1982). From the literature, it appears that the term is used in two distinct senses : *"undersized units which are too small for rational exploitation and the other is when an individual holding is split into many non-contiguous parcels"*. Various definitions are applied to these senses i.e. subdivision and scattering (Farmer, 1960), and fragmentation and parcellisation (Sanderatne, 1972).

Thompson (1963), describes three major categories of farm fragmentation. The rational, where the division of land holdings is either unavoidable or it is in the interest of agricultural progress, the incidental which happens as a result of reasons which are not related to agriculture, i.e. railroads, canals, irrigation works and finally irrational farm fragmentation.

One of the reasons why agricultural land is fragmented, appears to be the application *"of rigid inheritance rules exacerbated by high population density and rapid population growth"* (King and Burton, 1982) and the existence of the custom of dowry . Other reasons are the lack of uniformity in the landscape and the cultivation of different crops with individual cultivation requirements (Thompson, 1963).

It is in general assumed, particularly by agronomists and agricultural economists that farm fragmentation has a negative impact on the economics of the farmer since it usually implies more labour (moving from one parcel to the other), higher irrigation costs and problems for the mechanisation of agriculture.

One suggested solution appears to be land consolidation or farm enlargement and land reform. These fall under the umbrella of structural reform. Land consolidation is the rearranging of parcels into regularly shaped plots, reducing their number per owner, (optimum one plot per farmer) and providing the farmers with better access (Thompson, 1963).

The scheme does not always succeed or may only work temporarily. This may be due to the adoption of a narrow agro-economic approach , the roots of the problem are not dealt with and therefore the problem often reappears (i.e. inheritance laws and dowry). Also, land consolidation assumes that profit maximisation is the main objective of the farmer. However, it appears that *"the advantages of village life- social interaction and access to services- are frequently considered more important than the disadvantages of some separation of farmhouse and fields* (King, 1973).

Farm enlargement however, aims to reduce the number of farms which share the income of the agricultural sector. This reduction may be achieved by encouraging out-migration and according to Bowler (1975), three different schemes have been introduced by different governments to achieve this. These are: retaining schemes for farmers and sons of farmers in particular, retirement pensions or compensation for farmers who voluntarily retire and amalgamation grants. Experience shows however, that farm enlargement schemes have had limited success (Ilbery, 1985). One of the reasons for this is that small farmers are usually part-time and may do not depend on agriculture for a living. Another reason is that financial incentives are not always enough to make a farmer leave agriculture.

The need for examining the deep roots of farm fragmentation are underlined by Forbes (Forbes, 1976). As an anthropologist he approaches the issue by examining the cultural background of the farmers. The point that he makes is that land fragmentation ensured the equal division of a property between heirs and also protected against localised natural hazards. For example because of the variation in climate a natural hazard (hale) could affect one parcel near the hills but not another near the sea. Definitely however, farm fragmentation influences a framework for crop choice since combined with the size of the farm and the existence of irrigation, it can affect and even restrict a suggested cropping pattern. It is only by identifying its roots that one can say if it presents a problem for the agriculture of the area.

4.2.2 Land tenure

Land tenure also affects crop choice critically. A farmer's interest for the land or a crop may vary, depending upon whether they own or are tenants of the farm (Feder and Onchan, 1987; Riddell, 1987; Fujusaka, 1994). The owner for example may be interested in achieving capital maximisation, while the tenant usually targets a short term profit maximisation. Secure land tenure has always been considered as necessary for farmers to invest in land improvement (Fujisaka, 1994). Also, owning land is an expression of independence and of being your own master and farmers are in general characterised as independent by nature (Morgan and Munton, 1971)

The response of the farmer can also be quite different depending on the type of ownership e.g. communal tenure, latifundia, freehold or tenancy (Hurst, 1974). In the Western world the existing types of land tenure are the last two ones. Similarly, the inheritance laws and the dowry can have different effects upon land ownership in different way in different regions.

The level of education and the age of farmers can affect land ownership. Older farmers are often more closely linked to their land as such see it as more than an agribusiness. They may also show a preference towards crops which are considered "traditional" in the region, even though they may be less profitable than alternative crops. The age at which a farmer assumes full command of the land and the decisions relating to it is also very important. In Greece, for instance, with the current existing inheritance laws, the father has the final word regarding land management, even if for legal reasons the land appears to be under the management of his children or relatives.

4.2.3 Creating a typology of farmers

A framework for crop choice cannot be valid if it considers the farming population as homogeneous and does not take into account the various types of farmers to whom it is addressed. There are a number of distinct parameters which can distinguish between farmers, for example labour commitment to farming, the motivation behind farmers' actions, the attitude of farmers towards risk and uncertainty. The last one, is of particular importance. Also, the attitude of farmers regarding the adoption of innovations, needs to be examined separately . When research is not available to inform about a particular area , it is only through the interviewing of farmers that information can be obtained to support a typology.

4.2.3.1 The motivation of farmers

"If we want to know how or why a farmer acts in a certain way or how to induce him to act in a certain way, we have to enquire why men act, and especially why men act as they do when they live in the sort of social environment and general circumstances in which farmers live" (Ashby 1926).

Much research is devoted to exploring the motivation behind farmers' actions, especially after Gasson's paper *"The economics of part-time farming"*, (Gasson, 1973). Until then, profitability was considered as the main driving force behind farmers' actions and goals. The values, aspirations and the aversion to risk of farmers were either ignored or considered of negligible value. The idea *"that farm family members work together,. seeking to reach the common goal of a profitable farming operation"* is supported by many scientists up to the present day (Flora, 1986). There is, however, in contrast to this, a different approach adopted by social scientists, anthropologists, geographers (agricultural and behavioural geography), and researchers who deal with sustainable agriculture issues as part of interdisciplinary teams. They investigate the issue of farmers' motivation and decision-making Thompson (1986) for instance says that we must *"abandon the modern conceit that agriculture has no moral purpose beyond the economic goals of production and efficiency"*. The point made is that economic goals are only a part of a set of goals which include "self-reliance and connections to the land and to the community". As a product of this work, several classifications of the values and goals of farmers have been made. In general, the goals of farmers can be classified into two categories: those with an economic basis, and those that are focused on social and lifestyle concerns (Fairweather and Keating, 1994). Examples cited in the first category are farmers whose major goal is:

- To expand the business (Pomeroy, 1987).
- To achieve economic security (Gasson, 1973).
- To manage and run a business-oriented enterprise that optimises financial returns (Olson, 1988).

Examples in the second category are:

- "Farming as a means of self-expression or personal fulfilment" and it is work that is valued on its own right, (Gasson, 1973; Brown and Larson, 1973).
- Farming as a way of being independent (Kerridge, 1978).
- *" Farming for the sake of interpersonal relationships at work"*(Gasson, 1973).
- *"For bringing up children in a pleasant environment"* (Fairweather and Keating, 1994).

It is very difficult to generalise farmers' behaviour since it can vary considerably in different countries, regions or different farming systems. Social enquiry and statistical techniques should be borrowed to investigate the issue, for the farmers of the particular area which is in any case examined, qualitatively and quantitatively through interviews and questionnaires for a decided sample of the farming population. A framework for crop choice cannot be successful if the motivation of the farmers of the particular area is not carefully investigated, because it is through a deeper appreciation of farmers' motivation *"that we can gain a better understanding of farmers' approaches to the management of their farms"* (Gasson, 1973). By classifying the farmers into different management styles, it is easier for the researcher to study them. Examples of management styles described in the literature are:

- Entrepreneur (Olson, 1988).
- Accumulator (Pomeroy, 1987).
- Extensifier (Van de Ploeg, 1985).
- Dedicated producer, flexible strategist, environmentalist (Fairweather and Keating, 1994).

Finding the management style of the farmers of a particular area, can give a valuable insight into their way of thinking and making decisions. Important elements of farmers motivation are the attitude of farmers to risk, their approach towards innovations and the reasons behind the existing (if any) part-time farming. They are going to be examined in the following sections.

4.2.3.2 Full-time and part-time farmers

Part-time farming according to the Green paper of the European Commission, *"may mark a phase of transition, but can also very well represent a satisfying way of life in its own right"* (CEC, 1985). It is very common in many parts of Europe and it has started to be regarded as a way of solving the farm income problem and as a means to overcome the worst aspects of rural depopulation. It is definitely an issue worth examining and investigating.

Part-time farming may very often be a result of underemployment or *"hidden unemployment"* in agriculture. It is usually combined with a more gainful activity outside farming to which the farmer usually dedicates more time than to farming. Except for economic reasons, part-time farming may often constitute a way of life for the farmer by itself: there are *"hobby farmers"* who obtain only a nominal income from farming very often and who own a farm for recreational or residential reasons (Munton, 1974; Van Otten, 1980; Layton, 1981). Several ways have been used to try to define who is a full-time and who is a part-time farmer. It is usually linked with the working hours per year and with the income made from both sources: inside and outside agriculture. When examining the existence of part-time farming in an area, it is essential to find whether it exists as a result of underemployment or it has to do with the attitude of farmers to farming. Farmers who farm part-time by attitude very often tend to originate in urban areas and have only a little farming background (Ilbery, 1985). They can, however, be divided into "motivated" towards farming on a commercial basis and "non-motivated" sub-groups (Layton, 1979,1981).

If dealing with a majority of part-time farmers by attitude, there is not much chance that they would adopt crops which require a full-time commitment. This is a strong reason why crops which are expected to give a high profit are not very often adopted since their labour requirements do not fit the life-style of the farmers.

There are many factors affecting the labour commitment that a farmer could be willing to make; some of them could be:

- The income the farmer can make from farming alone, whether it is enough to make a living out of it or not. This is, very often linked with the size of the farm and with the crop grown.
- The status attributed by the farmer to farming; farmers attributing a low status to farming would be expected to seek employment outside of farming even if it is not really well paid. This is discussed in more detail in section 6.2.3.
- The type of crop grown, which may require low labour and consequently allows the farmer to search for off-farm employment.
- The age of the farmer: farming decisions have been found to vary with age (Jones, 1963; Ilbery, 1975) and younger farmers seem to prefer crops which give them a profit in the short-term. Younger farmers also seem to value leisure and recreation more than older farmers (Ilbery, 1987).
- The availability of family labour is also essential; usually women and children are considered as unpaid labour.

- The goals and aspirations of the farmer are critical for determining the expected labour commitment: for example, a farmer who considers farming as giving him social status, or who farms so that he can be "his own boss", will be a full-time farmer irrespective of profitability (Gasson, 1973).

All these factors need to be seriously taken into account because they directly influence the possibility of adoption or not of a crop.

4.3 Examining the crops which have been grown previously

In general, a farmer prefers *"to follow a pattern already established, either by himself or by somebody else, rather than attempt to re-evaluate the situation and make new decisions*" (Ilbery, 1978). Regarding crop choice, the farmers seem to be more willing to grow crops which have been grown "traditionally" in an area and the farmer is familiar with their special demands. It is considered that there is a good possibility that a farmer would not be willing to grow crops which have been affected by pests and diseases in the past. For this reason, before developing a framework for crop choice, one should examine the cropping pattern of the area, at least during the last three generations This helps to understand which crops the farmer perceives as "traditional", which crops there has been an attempt to introduce without success and the reasons for this. This saves time and a waste of effort, since the farmer seems to have valid arguments when rejecting a crop and those do not change very much over time unless there is a dramatic change of external factors affecting them. The attitude very commonly adopted by researchers in telling others what they should do and what they should grow, especially in the case of minor crops for which the option has been there for generations (and which were rejected), is "patronising" (Williams, 1989).

4.3.1. The role of risk and uncertainty in farming

A framework for crop choice needs to take uncertainty or risk into account and it actually needs to plan for uncertainty when a more sustainable agriculture is involved (Olson, 1992).

The presence of risk or uncertainty is very strong in farming. It is recognised that there is a considerable body of literature dealing with risk and uncertainty , risk or uncertainty. In this thesis, the two terms are used interchangeably (Mergos, 1987). The farmer is faced with all sorts of risks. Some of them have to do with biophysical factors like the variability of weather and various factors related to environmental quality like soils, water and other ecosystem components. Their degradation affects the agricultural production and essential ecosystem functions. Similarly, there are many socio-economic factors which can raise all sorts of uncertainties for the farmer. Some of them arise from national and international policies, the cost of inputs, output prices and price variability, market structure, farmers' health and ability to work, technological and market structures (Wolpert, 1964; Mergos, 1987). On one hand when planning for a more sustainable agriculture it is better that policy decisions are based on pessimistic predictions, this way the chances of a disastrous outcome are minimised (Costanza, 1990). On the other hand it is necessary that the attitude of farmers towards risk or uncertainty when a specific area is considered should be carefully examined as an essential variable in a framework for crop choice.
Risk is taken as a measure of the probability and severity of adverse effects and in this thesis it is used interchangeably with uncertainty (Kaplan and Garrik, 1981; Mergos, 1987).

A considerable number of models and policies dealing with various aspects of agricultural development are built on the assumption that the farmer acts as an economic man and his decisions are driven by profitability only. However, there is also the completely different approach that in agricultural management studies, that the farmer does not value profitability first and he acts as a risk averse person. *When advisors propose improved plans at the farm or regional level without any consideration of uncertainty problems", and by assuming that the farmers are rational, they show irrationality themselves; while the introduction of risk into this kind of model "is not sufficient, it can make them useful at least* (Boussard, 1979). Similarly, the reality shows that the farmer may very often reject profitable options simply because he is risk averse. Very often a farmer prefers *an assured income rather than a maximum income with risk attached* (Gasson, 1973). Gasson, as was mentioned previously, was the first to clarify that the farmers do not make purely economic decisions and that their attitude to farming is a result of their attitudes, goals and aspirations, with aversion to risk having a very important role in their decision-making.

The farmers are considered as very important actors in the agricultural development process and their attitude to risk counts in many cases, such as when adoption of profitable but risky technology is concerned i.e. irrigation technology, in the case of crop choice i.e. cultivation techniques, uptake of various policy schemes e.g. set-aside, credit use, output supply analysis, etc. (Binswanger in Boussard et al., 1985; Moore et al.,. 1994).

Aversion to risk varies depending on the age of the farmer, his income (financial reserves and ability to borrow), his family needs, education, training, farm-size, value placed on security and the enjoyment of gambling (Ilbery, 1985). Small farmers appear to be more risk averse than farmers owning a greater amount of land. Also farmers who make their living from farming only, will be more cautious before adopting a very risky option.

There are several cases of failure in the introduction of new crops in many cases because*" the intensity of cropping expected at the appraisal proved to be exceedingly optimistic"* (Baum and Tolbert, 1985; ODA, 1983). This in great part happened because of inadequate attention to risk and uncertainty effects on the cropping patterns at the time of appraisal. (Mergos, 1987). Also, aversion to risk is of great importance not only when the question is whether to adopt or not but also when the question is how much to adopt. Many studies wrongly assume that when a farmer is faced with the adoption of a policy, crop, technology etc. he will adopt it in full. It appears however that the degree of adoption is directly affected by the aversion to risk of the farmer (Saha et al.; 1994; Maddala, 1989). So, it is necessary to consider the aversion to risk of the farmer as an essential element in a framework for sustainable crop choice.

The first step towards achieving this at a conceptual level is to adopt techniques from social enquiry in order to establish how their perception of risk or uncertainty affects the decision making of the farmers. If a high profitability and high risk project is introduced, there is a great possibility that it will be rejected depending on how risk averse the farming population is.

4.3.2 Adoption of innovations

A framework for crop choice is expected to be applied for making suggestions for new crops in an area. A new crop is either a crop which is new to the area or one that has been created through biotechnology and can be considered as a totally new crop. The introduction of a new crop in an area is definitely the introduction of a form of innovation. Therefore, an essential element of a framework for crop choice is the attitude of farmers regarding the adoption of innovations and a consideration of the diffusion of innovations. A literature review can give a general idea about innovations and their diffusion. However, when the farmers of a particular area are concerned, it is only through interviewing them and through consideration of the specific conditions of the area over time that a picture of their attitude towards innovations can be created. Several factors can be identified from the literature, as affecting the adoption of innovations by the farmers (Jones, 1975). These include the age of the farmer, (younger farmers are considered better innovators than older ones), (Jones 1963; Ilbery 1975) the education, (more educated farmers are supposed to have a more positive attitude towards innovations and also access to sources of information is different depending on the level of education) (Ilbery, 1978; Saha et al., 1994). Similarly, it is useful to remember that irrespective of expected profit, expecting the immediate adoption of an innovation is unrealistic; therefore time should be allowed, when implementing a project, for its adoption by the majority of the farmers.

A considerable body of literature deals with the diffusion of innovations over time and space. Hagerstrand (1952) identified three types of regularities of diffusion of innovation: two in space, *"the hierarchy effect"* and the *"neighbourhood effect"* and one through time, *"the S-curve"* or logistic effect. The first two types cannot apply nowadays because of the advances of transport and communications. The S-curve however has been used by others also (Jones, 1975). The question then arises of whether the diffusion of an innovation depends more on information variables or on characteristics of the adopter himself (Blaikie, 1978). It is important when faced with a real problem not to generalise but seek the answer in the specific site. For sure, whether the farmer is exposed to information or not affects the adoption of an innovation critically. It appears that the critical phase before considering whether to adopt or not is the one of collection of information (Saha et al., 1994; L.A. Brown, 1981, M.A. Brown, 1981).

Several reasons are presented in the literature for the reasons for farmers not accepting innovations even though they are intended to contribute to sustainability. Some of them are:

- The innovation addresses the wrong problem : the farmers do not perceive the problem as such.
- The innovation is against the culture of the area e.g. the suggestion of land consolidation to solve the fragmentation problem has been faced with inheritance laws and the custom of dowry (Forbes, 1976).
- Farmer practice is equal to or better than an innovation. The innovation is too costly.
- The farmers refuse to invest for a long term profit or farmers who are "mining" the land, intend to abandon farming later (Fujisaka, 1994).
- The farmers are simply risk averse (Mergos, 1987).
- They prefer to follow a pattern already established rather than to re-evaluate the situation and make new decisions (Ilbery, 1978).

In conclusion, a thorough examination of the attitude of farmers regarding their adoption of innovation needs to be made before designing a framework for crop choice.

4.4 The Techno-economic subsystem

While the previous part of this chapter dealt with the socio-political subsystem of the generic framework, this second part is going to deal with the techno-economic subsystem. The variables included are going to be examined and their role in constraining or encouraging a sustainable agriculture is going to be discussed.

4.4.1 Capital

The availability of capital is a very important factor for the economic part of a framework for crop choice. It appears from the literature that it has been replacing land and labour in importance (Ilbery, 1985). Also, it can affect the successful uptake of various introduced technologies or structural farm changes critically. Similarly, the availability of capital determines whether the established type of farming is capital intensive or labour intensive (Grigg, 1974). The pattern of agriculture established in the developed countries is capital intensive and the percentage of the population working in the agricultural sector is very small. The agriculture is highly mechanised with a great percentage of inputs: fertilisers, pesticides etc. Developing countries' agriculture seems to suffer from availability of capital and it is in these countries usually that a labour intensive agriculture is established. Usually farming is a family business and it requires a high commitment. The overall capital available for agriculture depends on the government or international subsidies available, the banking system, the interest rates of loans and the private investment. Government in particular has a very important effect on the style of capital investment in agriculture. This is done through making grants and subsidies to the farmers and also through subsidising the interest rates of the loans. A framework for crop choice needs to consider the availability of capital as a factor of primary importance affecting crop choice. One example of an international source of capital is the EU which subsidises farmers in less favoured areas, or subsidises investment in infrastructure (Reg. 797/85, IMP). Definitely, one could not expect farmers to adopt a crop which requires high technical infrastructure, expensive seeds, fertilisers, etc., when capital is not available or it is difficult or expensive to borrow.

4.4.2 Market and transport

The role of the market is critical when discussing and planning a framework for crop choice. The absence of a market has often been reported as a reason why a crop has not been adopted or why it has been abandoned soon after its introduction. Quite often crops are suggested which perfectly suit the biophysical conditions of the area under consideration but nobody has investigated whether there is a market for the product before its introduction. A farmer will need to know what yield of product he can obtain and what price he will get for it when presented with a suggestion for a new crop (Corley, 1989). Market demand can depend on many factors like the size of the affluent population, consumer preferences, cultural beliefs, whether the product is part of a staple diet or it is a luxury etc.

The development of new crops need to be market led and developed to meet specific needs more cheaply and effectively, fitting into the market and the industry without requiring any major changes in the market grades or the industrial equipment. (Meadley, 1989). When discussing market demand, one question which needs to be answered is the purpose of the choice of crop or to which of the following categories it belongs: food, energy, environment, bio-technical raw materials or socio-economic cultural benefits (Green, 1989). Choosing a new crop for an area implies change and *"the key to change is that production should be determined by demand",* (Tayler, 1989). For a crop to be successfully adopted, appropriate markets should exist ,whether new markets or new uses for existing crops or new markets for new crops. The way of marketing the crops needs also to be examined: individually in local markets, through co-operatives at the national level, through co-operatives in international markets etc.

Another factor when choice of a crop is discussed is what is the position of the crop in the market currently. It would be of no use for instance to suggest a crop which is already in surplus, which is very often the case.

Viability of markets is also essential. If availability of a market for the crop is important, the viability of the market is the other factor which needs to be taken into account.

The role of market is directly linked with the availability of transport. By transport is meant the cost of moving raw materials from the farm to the place of consumption, the time required, the type and cost of transport. The later does not seem to be as much a problem in the developed countries as it is in the developing countries. Although the Von-Tunen model is considered as old fashioned today, (Waugh, 1995) transport does affect crop choice when the market for the crop is far away from the place of production and the farmer has to market the product individually. Similarly, the cost of transport may change the cost of the crop considerably if the farmer produces small amounts and markets the crops individually.

4.4.3 Technology

The available technologies in an area e.g. irrigation, fertilisers, pesticides, various forms of machinery can affect crop choice dramatically. The technological achievements of the last thirty years e.g. green revolution, expansion of irrigation projects, the achievements of biotechnology contributed to extending what was considered as optimal conditions for a crop or the optimal area for cultivation. However, after the 80s, the phase of believing that technology is a "panacea" and through technology all the natural constraints can be overcome was over. Serious concerns started arising about the side-effects of the introduction of various forms of sophisticated technologies. One example is the research done on the implications of the Green Revolution which was initially welcomed as a miraculous solution for the developing countries. Research showed that the Green Revolution was not a scale - neutral technology, but one that could transform the basis of rural life for large numbers of people (Altieri, 1987). It did contribute to impressive increases of staple grains but it created more problems by marginalising even more the resource-poor farmers. It was the rich farmers who actually took benefit of it and by contributing to the increase of the vulnerability to pests and diseases due to the narrowing of the genetic basis of agriculture (Perelman, 1977). Nowadays, the typical top down technology transfer approach where scientists define problem and opportunities and then suggest new high-yielding crops does exist. However, a different approach, the one of Farming Systems Research has gained ground. In this method, the problem is defined with the collaboration of the farmers, the research and development is done on farm and finally the farmers test and evaluate the suggested technologies (Chambers and Ghidyal, 1985). The need however for research moving away from working towards improvement of existing forms of technology only and considering site-specific technologies has been underlined in the literature.

Similarly, when seeking options for a more sustainable agriculture, an option which is absolutely dependent on external technologies cannot be considered sustainable. Many scientists sympathise with the approach that everything can be grown nowadays with appropriate technologies but the question is at what economic and environmental cost. Before considering the choice of a crop, the relevant technology is a factor which needs examination. In particular, a factor which needs thorough consideration is the existing technologies in the area and their role in agricultural production.

Considering the triangle agriculture-technology-environment, a common conclusion of research about sustainable agriculture is that many technologies which contributed to high productivity (high yields), had an adverse effect on the environment. One example is the introduction of irrigation technologies which on one hand increase yields and on the other in some cases can contribute to groundwater depletion, overuse and contamination of water, subsidence, salt problems, and the destruction and stress of aquatic ecosystems (Poincelot, 1986; NRC, 1989).

What type of technologies need to be introduced for the specific needs of the area. There are various forms of agricultural technologies which are considered as having a high potential sustainability; e.g. intercropping, rotations, agroforestry, sylvo-pasture, green manuring, conservation tillage, biological control, integrated pest management (Conway, 1990).

Sustainable agriculture has tended to mean "low-input" (Lockeretz, 1988). An agriculture which is highly dependent and maintained only through an expensive and very often damaging the environment infrastructure, cannot be considered as sustainable.

4.4.4 Governments

National and international policies can have a dramatic effect on crop choice and can affect the decisions of the farmers critically. There are various forms of government or international intervention in "free market" agriculture. Some of them are mentioned below.

National subsidies, which raise the producer's income while lessening the cost to the consumer. Guaranteed price for farming products which involve the government in either buying up stocks of the commodity not required by the public at the guaranteed price, and retaining them until some subsequent period of shortage, or buying the entire output of the producers and absorbing any losses incurred at the current resale price. Quotas, which determine the limits of the produced amount of a product, and aim to avoid surpluses. Other factors are agricultural training schemes, advice on new methods, improvement grants, along with sponsoring of research, dissemination of information to farmers. Programmes designed to reduce the real costs of production while increasing demand, crop-limitation programmes designed to reduce supply and so raise farm-prices (Smartt, 1989).

It is important to examine the national and international policy affecting a region before discussing crop choice. Very often, the perspectives of researchers and policymakers do not coincide with the effect that options which are considered appropriate from the scientific point of view are not feasible for the policymakers. Also, policies very often plan for the short to the medium term and they end up in the long term contradicting themselves. e.g. promoting and subsidising a crop for which there is no market when the crops come to full-production. Or promoting crops which put the environmental resources of an area in jeopardy: e.g. suggesting heavily irrigated crops in areas which suffer from lack of water, or which contribute to the further degradation of already degraded resources. When considering crop choice for a region, one should not consider the narrow geographic limits of the area only but the wider geographical scale hierarchy the area belongs to. That's why a systems' approach needs to be considered and an hierarchical perspective needs to be adopted (Lowrance et al., 1986) to have the complete picture of the factors affecting the area. For example, the agricultural production of a country in Africa may be affected by the EEC subsidies and quotas and may make the option uneconomic because it affects its market potential. Or the olive tree, which is a perfectly suitable crop for the Mediterranean could not be suggested as a rainfed, low input alternative, because of the existing CAP.

4.4.5 Land

Land is one of the three main resource inputs that affect productivity. The other two are labour and capital (Conway, 1990). By "land" is meant *"an area of ground upon which some characteristic pattern of land holding, distinctive in size, shape, internal arrangement and degree of fragmentation or consolidation, is likely to occur".* (Newbury, 1980). In an agricultural context "land" means land without development of any kind. When examining land as a factor of productivity, in the context of crop choice it is worth examining the various types of government intervention and land reform concerning the land in the particular country or region and also the cultural background of land ownership. This was done in the sections about land tenure and fragmentation.

4.4.6 Labour

A definition of labour given by Newbury is :
"labour is applied to land in certain organised relationships and employing operational skills in accordance with the regular and effective pattern which accords to that system, although modified by local differences in the culture and technological attainment of the particular people concerned" (Newbury, 1980).

There are several factors affecting the level of labour inputs, such as l its cost and availability, the type of farm system practised, land quality or the desire to obtain a particular level of output (Ilbery, 1985).

Similarly, for a majority of farmers and farm labourers, farming remains a traditional occupation and for this reason farming labour is less occupationally mobile than other forms of employment (Gasson, 1968, Ilbery 1983b).

Labour as such is a crucial factor in determining the system of agriculture practised in a region. As was mentioned in the section on capital, quite often where labour is plentiful and cheap, capital and quite often land are in short supply. A high decline of the amount of labour is observed in the developed countries' agriculture. The reasons for this are many. Some of them are the technological change in agriculture which has contributed to releasing labour (Morgan and Munton, 1971).The low wages of farm workers compared to the other types of employment and the underemployment observed in farming due to the seasonal requirements of crops is another reason for the low farming labour. When crop choice is concerned, a thorough examination of the availability and type of labour available needs to be made. Labour affects prices of crops crucially. Similarly, depending on its cost and availability, it is a main factor affecting whether a crop can adopted in an area or not.

4.5 Summary

Chapter 4 has examined the attributes that a generic framework should include from the socio-political and techno-economic point of view. These are:

- Farm fragmentation
- Land tenure
- A typology of farmers
- Motivation of farmers
- Full-time and Part-time farmers
- An examination of the crops which have been grown to a particular area previously
- The role of uncertainty and risk in farming
- Adoption of innovations
- Capital

- Market and transport
- Technologies
- Governments
- Land
- Labour.

The following two chapters will consider the case study area which is the Argolid Valley in Greece. Chapter 5 examines the area from the biophysical point of view and from the point of view of existing technologies.

Chapter 5

5. Argolid-the biophysical subsystem and technologies relating to it

5.1 Introduction:

This chapter and the following one deal with the application of the generic framework to a particular area, the Argolid Valley in Greece. A general introduction of the area is followed by an in detail examination of the biophysical and technological changes that have occurred within it. These changes are mainly related to the expansion of irrigated agriculture and the resultant resource degradation. This means that a framework for more sustainable agriculture is of contemporary importance for the area. The generic framework will be tested and amended in the light of the findings.

Part of the data used in this chapter were collected for the fieldwork for the Argolid project under Archeomedes (see Section 1.2.2). The specific scope of the project (Allen et. al., 1994), was:

1. The development of a complex systems model of the agrodynamics and changing land use of the area.

2. To understand the dimensions involved in the perceptions of water resource issues by the inhabitants and

3. The modelisation of alternative strategies of response to policy in a complex systems model.

The sources for data for this work were the Agricultural University of Athens, the Service of Agriculture in Nafplion, the Office of the National Census Service and the Service of Land Reclamation (YEV). Similarly, an in depth search was undertaken at the local libraries of Danaos in Argos and Palamidis in Nafplion which yielded valuable existing literature by local authors on the historical evolution of crops and water resources of the area.

5.2 Background to the Argolid Valley in Greece

The Argolid Valley is situated in the Peloponnese of Southeast Greece, approximately 200 Kms South West of Athens (Figure 5.1).

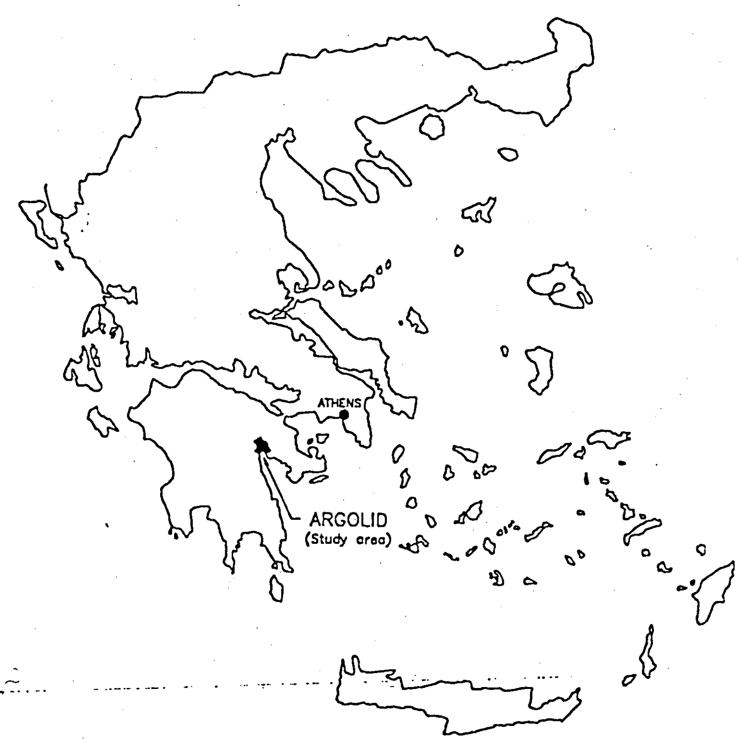

Figure 5.1: Map of Greece showing the study area

In defining the agriculture of the area it is necessary to examine the area in a wider geographical context. The Argolid is not only a region of Greece but is representative of a Mediterranean agricultural system which is affected by European Community policy and regulations.

The area is considered to be one of the most prosperous regions of Greece. It has good access to the sea through the port of Nafplio, very fertile soils and is rich in ground and spring water. The current source of its wealth are mainly agriculture and tourism with extensive monocropping of citrus trees and a combination of cultural[1] and "beach" tourism.

The Argolid has experienced agricultural expansion since the second World War. This rapidly increased after 1950 with the introduction of drilling technologies and the cultivation of citrus trees, in particular oranges. Irrigated agriculture has replaced the traditional rainfed practices which were established in the area. In order to meet the irrigation requirements the pumping of underground water has had to increase

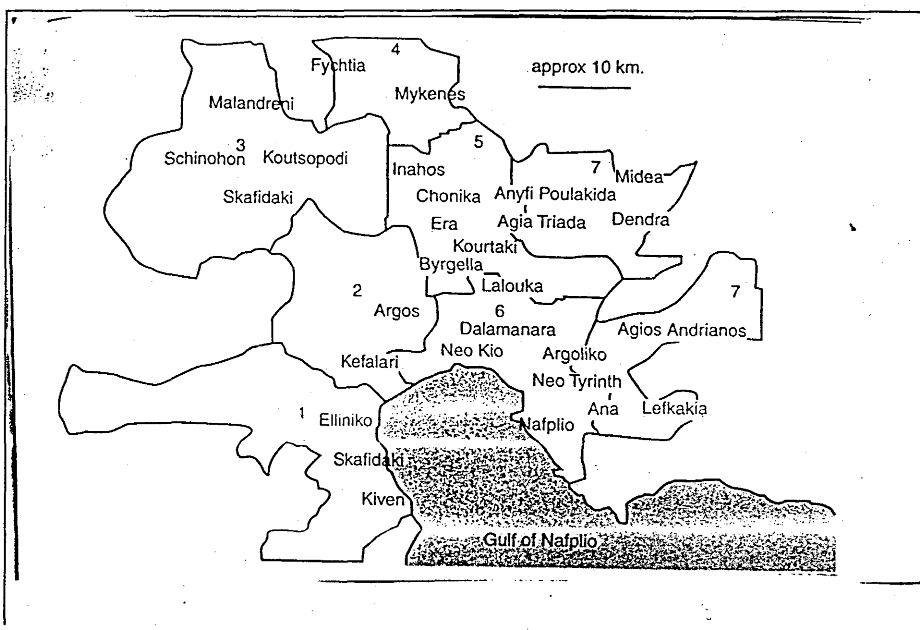

Figure 5.2: Map of the Argolid showing the study zones adopted for Archaeomedes

dramatically, especially near the coast. This has resulted in sea water intrusion, and salination of 2000 g/ml in some coastal areas, and the depletion of ground water stocks with some boreholes reaching 450 m. in depth in the peripheral regions (See map- Fig 5.2). The altitude of the central plain is between 0 and 20 m above sea level and the peripheral foothills rise to a maximum of 200.

[1] The famous archaeological sites of Mykine, Ancient Tiryns, Epidauros and Argos are found in the area.

5.3 Physical characteristics of the Argolid

5.3.1 Climate:

The Argolid has a Mediterranean climate with a definite influence from the continental European climate. The mean monthly temperature is 8-10°C during January and 28°C during August. However, minimum temperatures can be as low as -5°C and maximum ones as high as 45°C. Continentality increases with distance from the sea and as far as temperature is concerned, inner areas are cooler than coastal areas by about 2°C. There is a high risk of frost for the period between November and March with five days of partial frost in areas close to the sea, but nearly 25 days elsewhere in the coastal plain. North westerly winds also reduce the danger of frost in much of the western periphery. Winds from the south and the north blow with a mean velocity not exceeding 2.5 Beaufort in the coastal area but are usually stronger further away from the sea.

The winter period, apart from being the coldest, is also the most humid (around 75% relative humidity) and the most rainy period with the highest monthly mean precipitation (slightly less than 110 mm) in December. The least humid month (July) with relative humidity of less than 55% has an average precipitation of less than 10 mm but does not always coincide with the driest month which varies between June and August. The yearly mean precipitation, slightly over 510 mm, is recorded within about a 90 day period in winter.

It has been argued in Chapter 3 that as far as crop suggestions are concerned, it is very important to consider not just mean monthly or annual temperatures, but also average day temperatures. This way low frost temperatures are taken into account. While, if only mean monthly temperatures are taken into account, a mean minimum temperature of 8°C does not represent temperatures of -1°C to -5° which occur every winter and can have disastrous consequences for the crops. Major crop disasters in the area have been reported by the farmers because of heavy frosts (e.g. the frost of 1987 when not only the crop, but also the orange and olive trees as well were destroyed). Similarly, it is not the total rainfall for the year which is of interest, but its annual distribution. Rainfall is concentrated in a period of 5 months per year (November to March) and this is an important factor if rain-fed crops are to be considered.

5.3.2 Soils of the Argolid

The soils of the Argolid valley can be classified into five types on the basis of the mechanical composition of their top layer. These are silt loam, silty clay loam soils, clay soils, clay loam soils, loam soils and sandy loam soils. The largest part of the main valley has clay soils and in the periphery the dominant types of soil are clay loam and loam soils. Figure 5.3 shows the distribution of soils in the central area, the

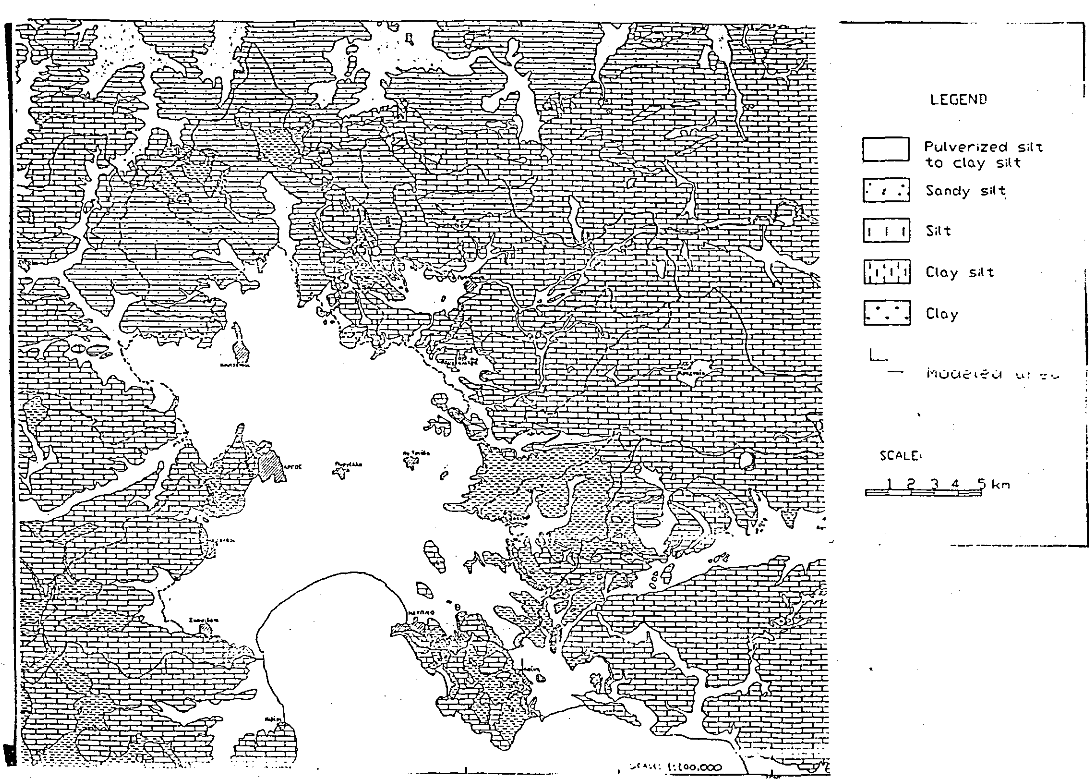

Figure 5.3: Soil map of the Argolid

loam soils are located outside of this.

The soils of the Argolid valley tend to be fine textured. Citrus crops prefer well-drained soils and some rootstocks do poorly on clay soils. The high water holding capacity of the soils which are also high in $CaCO_3$ accentuates the lime-induced chlorosis (reduced chlorophyll) problem. Some of the soils of the Argolid valley have low permeability with about 22% of the soils having an infiltration rate of 2 cm/ha or less. The high clay content of the soil is partly responsible for this. Also low levels of soil organic matter with the high clay levels result in fairly poor structure in some cases.

One conclusion from this examination of the soils of the Argolid is that there is an enormous variability of soils and this should affect the choice of crops that are grown. However, this variability does not seem to be represented by the crop choices of the farmers or the guidance provided by agronomists from the Service of Agriculture. Interviews carried out with farmers showed that, irrespective of whether they have a farm with a clay or a sandy soil, may tend to opt to grow oranges. Therefore the type of soil does not appear to have a marked influence over the selection of crops. However, it should provide a basis for zoning the area in a more practical way. Thus, from the soil criterion only, there is no reason to justify the maintenance of a monoculture.

The soil requirements of citrus tree are as follows:

Soil depth	Deep	Medium
Soil Drainage	Well drained	Well/excessive
Soil Fertility	Medium	Low
Soil Salinity	Low	L
Soil texture	Light/medium	Wide range

Table 5.1: Soil requirements for citrus trees (FAO, 1994)

So as far as depth is concerned citrus trees prefer deep soils (more than 150 cm), however, they can do well in moderate soils (50-150 cm). With regard to drainage, they prefer well-drained soils but those which are excessively drained are acceptable. Citrus trees grow in soils of medium to low fertility and because they are sensitive to salt in conditions of low salinity (less than four dS/m (mmhos/cm). The plant will grow in a wide range of soil textures but the optimum are light or medium (sand and loamy sand, sandy loam, sandy clay loam, clay loam and silty clay loam). So, from the point of view of soil type, it seems that the periphery is more appropriate for the cultivation of citrus trees than the central valley. However, as will be seen the periphery suffers from poor water availability and orange trees are a highly water demanding crop.

5.3.3 Water resources of the area

The Argolid has since ancient times been characterised as an area lacking water. For example the Argos region was characterised by Homer as *polidipsion* (very thirsty) and *anydron* (lacking water) (Zeginis, 1967). The precipitation for the area has already been introduced and briefly considered in terms of evapotranspiration and infiltration. This section deals with the natural water resources of the area prior to the extensive introduction of technology. The following section will then look at the influence of these technologies.

The Erasinos river emerges from Kefalari spring five kilometres to the west of Argos and historically has run to the sea. The spring is rainfed and therefore the water varies each year. It has water of good quality during the winter and is usually dry during the summer. Considerable efforts are now made to prevent the water loss to the sea and to use it for the replenishment of groundwater.

The Inahos river (Panitsa) springs from the Artimision mountain in Arkadia, it is joined by the Haradros (Xerias) river in the central valley and flows to the sea. Both are dry rivers and have water only during the winter when there is a considerable amount of rainfall. However, they often cause floods especially after storms and for these reason suggestions have been made in support of a system of dams for storage and protection.

The lake of Lerni is found near Kefalari and is famous from Greek Mythology as the place where Hercules killed Hydra. The water of Lerni is of very good quality and current research, undertaken by the Agricultural University of Athens, suggests a number of projects that prevent its loss to the sea and its possible use as a source of potable water.

Kefalari spring and Lerni are the only sources of good quality water in the Argolid. Their concentration of chloride (CL) is about 0.5 ml/lt. and the Electric Conductivity is about 0.5 mmho/cm. The springs deliver about 1.4 /m^3 sec which is sufficient water to irrigate 5,200 hectares with about 3,500 m^3/ ha/year. However, for seven months of the year, spring water flows to the sea.

Along the shore of the Argolic gulf there are many other small springs. The most famous of these is Anavalos near the village Kiveri (ancient name Genesio). The water emerges into the sea at a depth of 8-10 meters from the Arkadia mountains. A large dam is built for the collection of this water.

The water from Anavalos is distributed by canal to the central valley of the Argolid and is seen as the main hope of the people of the area and the only solution that science can offer in order to maintain existing irrigated agriculture. The Anavalos' springs have a total discharge of 13 m^3 per second and a mean NaCl content of 10meq/lt; so if no leaching occurs, it can result in the accumulation of salts with disastrous consequences for the agriculture of the area -especially because of the low rainfall of the Argolid.

During the seven months when it is not used for irrigation, water from Anavalos is used partly for recharge of the underground reservoirs according to unpublished information provided by the AUA[2] . It is calculated that some $215x10^6$ m^3 could be added to the underground reservoir, which is about 16% of its capacity. In this way, underground water equivalent to about 40 million cubic meters could then be pumped safely during the irrigation season. With this amount of water between 29,000 and 37,000 ha could be irrigated in the plain which has a surface area of about 700 km^2 or 70,000 ha, however the implications for soil and water quality arising from this must be considered.

$150x10^6m^3$ of water from Anavalos springs is used for irrigation in the Argolid every year with a mean NaCl content of 10 meq/lt. This results in 90,000 metric tones of NaCl deposited on the area's soils every year. This corresponds to about 3500 kg/ ha/ per year and will render the soils of the Argolid unsuitable for agricultural use if the salts remain in the soil profile. Partial leaching is caused by rain water, however it is doubtful if rainfall alone could remove the salts at a sufficient depth below the root zone.

In addition to this, the leaching of the salts implies their transportation to the ground water contained in the unconfined and semi-confined aquifers. The clayish layers separating the semi-confined aquifers (which are found in the central part of the Argolid plain) may slow down the mixing of the leachates with their water but in the coarse sediments at the border of the plain where most of the natural recharging occurs, there do not exist layers of low conductivity to stop leachates from reaching the ground water.

Citrus can tolerate a CL^- level of 180 g/ ml if it is leached and not allowed to build up in the soils. However there are many examples of citrus trees damaged by this level of Chloride e.g. in California where citrus has been injured with 200 g CL^-/ml after 15 years of irrigation. The injury happened because of the build up of 500 ppm of CL^- in sandy soils (Wallace, 1976).

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[2] AUA: Agricultural University of Athens

The use of Anavalos water for irrigation in areas with one uniform unconfined aquifer may result in a continuous deterioration of groundwater quality finally rendering it unsuitable for irrigation. For this reason, the scientists from AUA recommended that the use of water from Anavalos springs should be restricted to the central part of the Argolid where the underground aquifers are sandwiched between relatively impermeable clay layers. One suggestion is that a drainage system should be introduced in order to check the rise of the water table and to eject the leachates to the sea (Kerkides et al, 1994).

In conclusion, the water of Anavalos which is the only source able to cope with the current irrigation needs of the highly salinated central valley, is not in itself good quality and will degrade the environment in the long term (Wallace, 1976; Argolid Association of Agronomists, 1992).

5.4 Agriculture in the Argolid after the expansion of irrigation

The increase in the irrigated area, which has been supported by the water sources discussed above, is shown in Table 5.2.

Dates	1945	1965	1985	1990
Irrigated areas (ha)	5,500	12,500	17,000	19,500
Irrigation water (m^3/ha)	45	100	135	145

Table 5.2: The development of irrigated agriculture (source: AUA, 1992)

This has resulted in a movement away from traditional Mediterranean rainfed agriculture (olive oil, rice, cereals, tobacco, vegetables and melons, raisins and wine) characterised by polyculture and diversity in the cultivations. Usually olives were grown in the hills surrounding the valley and the main valley was for cereals and vegetables and also vines which were grown equally in the valley and on the hills. Table 5.3 shows how this change has occurred in terms of crops grown in the area.

Crops	Non-irrigated		Irrigated		Total	
	1965	1990	1965	1990	1965	1990
Citrus trees	-	-	7,000	11,200	7,000	11,200
Vegetables	-	-	5,500	2,250	5,500	2,250
Olive trees	4,500	6,760	-	230	4,500	6,990
Cereals	6,500	1,840	-	-	6,500	1,840
Tobacco	900	-	700	2,120	1,600	2,120
Vines	200	-	-	80	200	80
Fodder	3,000	1,860	-	200	3,000	2,060
Other trees	-	180	-	1,600	-	1,780
Total	15,100	10,640	13,200	17,680	28,300	28,320

Table 5.3: Change in area (hectares) for the main crops grown in the Argolid Valley (source: Agricultural University of Athens).

This table shows that there has been a dramatic increase in irrigated crops particularly citrus trees. This increase was coupled with and encouraged by the introduction of technologies as it can be seen in Figure 5.4.

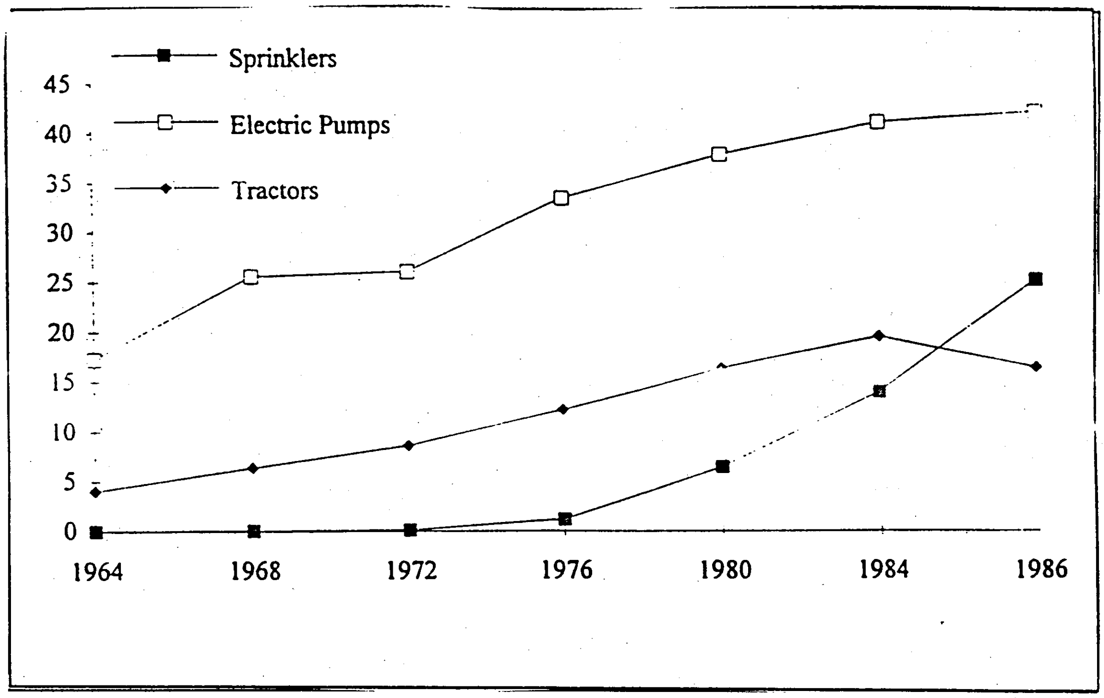

Figure 5.4 Units of technology per 1,000 stremmata of irrigated land (source: Service of Agriculture)

This increase, as it was mentioned in Section 5.2, resulted in sea intrusion into the acquifer for the main valley and at exhaustion of the acquifer for the periphery. In the periphery in particular the depth of pumping reached 420m. Another problem that had to be faced with the expansion of citrus trees was an increasing frost problem. So, except from the sprinklers (which are a primarily used for irrigation and secondarily for protection against frost), another form of technology was introduced, the air-mixers. (Figure 5.5).

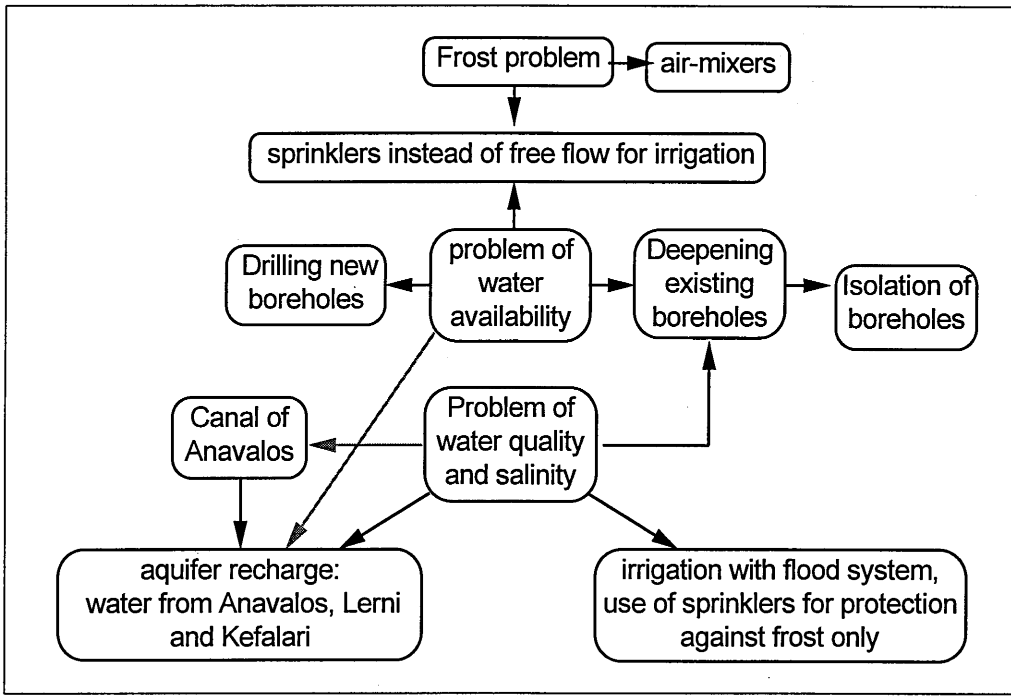

Figure 5.5: Technologies necessary for the cultivation of citrus trees in the Argolid

5.5 *Technological attempts to remedy the problem in the Argolid valley*

The approach adopted after the appearance of the water quality problem seems to be a purely technical one. Figure 5.6 illustrates the development of the technologies which were introduced.

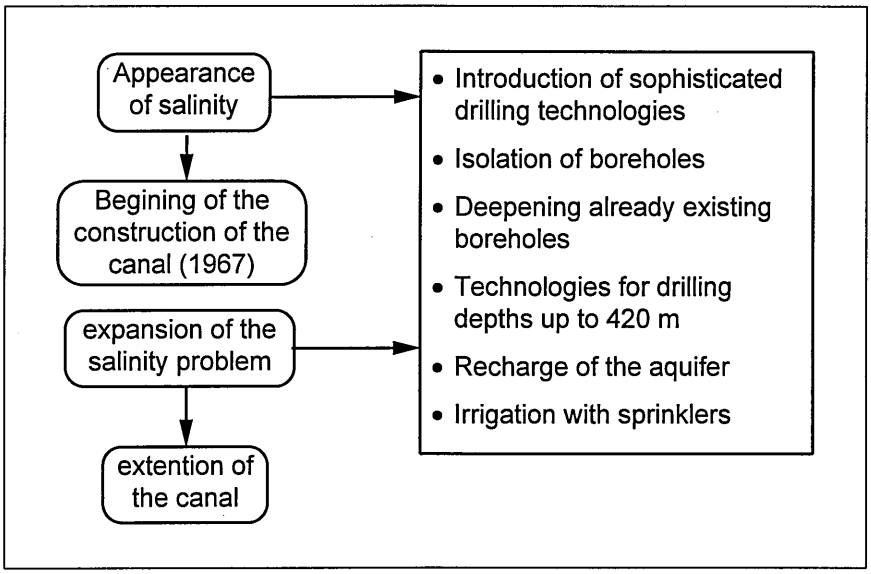

Figure 5.6: Technologies dealing with water issues

The fact that the salinity problem appeared almost as soon as a small part of the valley was planted with citrus trees did not act as a warning sign for the scientists and the policy makers and to an even greater extent for the farmers. That's why thirty five years after the first signs of salinity appeared and ten years after serious signs of a lack of water in the periphery, more oranges are still being planted.

Both scientists and policy makers have attempted to find solutions to the degradation through the introduction, or expansion of technologies. In this way, the cultivation of orange trees has been maintained but only with very large technological inputs. Figure 5.5 shows the technologies currently used for the production of orange trees in the Argolid.

An attempt to resolve the problem was through the construction of the canal of Anavalos (for the irrigation of the salinated main valley) and by allowing the drilling of more boreholes (of an increasing depth) in the periphery.

During all these years, the only restriction placed on the farmers against drilling more boreholes was that they were not allowed to drill closer than 50m from an existing one. Considering the small size and the fragmentation of the holdings (see Chapter 4), it is easy to understand that the effect of over-drilling and over-pumping was the mining of the water.

On the other hand, Anavalos, which is supposed to be the optimum solution to the water problem, is not really an optimum option. As was mentioned previously, (Section 5.3.3), it adds salts to the soil in the long term. So, if the current situation continues, the accumulation of salts is likely to have dramatic consequences.

Another technical solution used to remedy the water quality problem is the introduction of aquifer[3] recharge. This technique the started being used about five years ago, at an experimental level at first and recently more widely. According to

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[3] Aquifer recharge: The water from Kefalari and Anavalos springs is injected into old wells to improve the quality of the water of the acquifer.

unpublished information, provided by the AUA, the results seem promising: the water level tables, and the quality of water seems to be improving. It is however too early to draw conclusions about the long term effect that the recharge can have on the aquifer.

The next section will discuss the change of crops and agriculture in general after 1960.

5.6 The change of agriculture after 1960

Before 1960	**After 1960**
Rainfed Agriculture	Irrigated Agriculture
Diversity	Monoculture (especially in the valley)
Each holding grows two-three different crops at least (co-cultivation)	Strict monoculture in the valley; a smaller form of diversity in the periphery
Crops consist mainly of annuals	Perennials are mainly grown
The crops grown suit the climate and do not need external technological support	Intense technological support needed to irrigate the crop, to protect it against frost, to compensate for environmental damage created because of irrigation.
Close nutrient cycles	Open nutrient cycles
The perennials grown are primarily olives and vines which are rainfed	The perennials grown are mainly irrigated (citrus trees) and much less olives and vines.

Table 5.4: A general comparison of agriculture in the Argolid before and after 1960

Olive trees have always been a non irrigated crop in the area. However few olive trees are planted because of the instability of prices and markets during the last fifteen years. A dramatic decrease is observed for vegetables, cereals, and vines. Interviews with farmers suggest that this decrease has occurred because the farmers preferred growing orange trees instead, largely because of the income it was giving to them and the low labour requirements. Tobacco has decreased dramatically because of the EU intervention in prices, and removal of price support, which led the majority of the farmers to hand in their growing licences and receive the subsidy for terminating the cultivation. So on the one hand the agriculture moved from a rainfed one to a highly irrigated one and on the other hand a high decrease of diversity was observed as the main valley shifted to monoculture.

Crop	Vegetable	Lemon	Orange	Mandarin	Apricot	Olive	Cereal
%	-10	-92	14	88	-23	19	-24

Table 5.5: % crop change in the Argolid Valley (1978-1991)
(source: Service of Agriculture, Nafplion)

It can be seen from Table 5.5 that lemons have disappeared almost completely from the area while apricot trees have decreased by 23% and cereals by 24%. Pests and diseases are the reason for lemons and apricots disappearing from the area. Lemons were actually introduced into the Argolid valley before orange trees and their number originally increased more rapidly. They were however almost completely uprooted because of the fungi *Deuterophoma tracheiphilla* (Coryphoxera) combined with a period of very heavy frost. Apricot trees have been another successful crop in the Argolid. They were particularly grown in the periphery of the valley which met their requirements for good drainage, high organic content and milder climate. They were considered to give a good income with only minor labour requirements. Most of the uprooting of the apricot trees of the Argolid has been in response to the *Sharka* virus. The farmers who were growing apricots, were growing them either as a monoculture or in co-cultivation with oranges and most of the land occupied previously by apricots was afterwards planted with orange trees.

Cereals (wheat), are mainly grown in the semi-mountainous or mountainous areas of the periphery of the valley. The low levels of price support and the low prices of wheat per kilo compared to the price of bread, combined with many dry years to contribute to the decrease in cereals. An additional factor was the migration away from these villages because it was not possible to make a living there in general and more specifically from farming wheat or cereals.

5.7 The role of policies in the adoption of crops

Prior to 1981 the policies which have critically influenced the cropping pattern of the Argolid were primarily national. Since 1981[4]and the entrance of Greece to the EU the community has played an increasingly important role. Their influence seems to have been crucial for the rapid development of oranges. In addition to this they have led to the uprooting of many previously grown crops. The successful establishment of oranges was the main reason for the radical change of crops which occurred in the valley. However, there are many reasons why several crops were uprooted and replaced by oranges. Some of these are external to the system and are due to the introduction of policies or new technologies. For example, the disappearance of tobacco, mandarins and vines occurred because of specific policies. Before the second world war, tobacco as a rainfed crop used to be very important for the area. The crop was cultivated with licences given to the farmers of mountainous or semi-mountainous areas to discourage movement away from the villages. However these farmers used to rent these licences to other farmers in the valley where tobacco was also grown as an irrigated crop. The basic regulations affecting tobacco are the EU No. 727/70, Reg. 1461/82 (OJ L164, 14-6-82), Reg. 1576/86 (OJ L139, 24-5-86), Reg. 1579/79 (OJ L189,27-7-79). The last two regulations affected the production of the tobacco of the Argolid critically. The first of them introduces the concept of a reference quality of specified varieties, grown in recognised production areas, in an attempt to limit the production of tobacco to traditional growing areas. The second,

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[4] Information for this section on the role of EU policies was taken from the book "The Common Agricultural Policy of the European Community" (Fennel, 1992).

established the intervention mechanism. In 1992 a large number of licences were returned by the farmers because of the EU legislation which offered them compensation to do so. The varieties grown were considered as uneconomic by the EU but no other varieties were suggested in their place.

Mandarin (Clementine mandarin) is another case of a crop which was both encouraged and discouraged by EU policies. Many stremmata[5] were planted with Clementines mandarins after 1982 (Extension of original Reg. EU NO. 2511/69, which was extensively amended under Reg. 1204/82 (OJ L140, 20-5-82). Clementines were planted as part of *"the conversion of orange, mandarin or lemon plantations to other varieties of the same species or to other citrus"* (Article 1 regarding infrastructural assistance). They were a subsidised crop which was supposed to give a good income to the farmers. However, when the trees started to reach full production there was no market for the crop and the farmers received EU subsidies to withdraw their production. Common mandarins, which were the first variety grown in the Argolid, were uprooted in 1990-1992. It was considered that there was no market for the crop and that there was *"a need to change to more saleable varieties and to improve post-harvest handling and processing"*. Reg. 1204/82 (OJ L140, 20-5-82).

The traditionally grown varieties of vines for wine in the periphery of the valley were also uprooted with the support of EU policy in 1987-1990. The original EU Regulation was the EU NO. 456/80. Under it, two types of premium were offered for abandonment of the vineyards: one temporary and one permanent. Under the first, the grower agreed to uproot the vineyard and refrain from replanting for eight wine-growing years. The permanent abandonment premium involved agreement not to replant for fifteen years. The Argolid was affected by the successor of this regulation which is Reg. EU. No. 777/85 *"on the granting, for the 1985/86 to 1989/90 wine years, of permanent abandonment premiums in respect of certain areas under vines* (OJ L88, 28-3-85). Especially for Greece, Regulation (EU) No 895/85 *"on a common*

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[5] 10 stremmata = 1 hectare

*measure to improve the structures of the wine-growing sector in Greece" (*OJ L97, 4-4-85) was introduced because the previously mentioned Reg. 458/80 was judged as *"unsuited to the particular problems of the Greek wine sector"*. The varieties grown in the Argolid were part of the uneconomic varieties. Vines have been a traditional crop for the area and suit its climatic conditions perfectly. However, the uprooted vineyards were not replaced with others. An effort to plant new vineyards has started in the last four years in the Argolid. It is based on the initiative of a small number of farmers. One crop which did well, to a great extent because of subsidies (national and EU ones) is orange trees.

There are also crops which ceased to be grown or are grown to a lesser extent because of competition with the oranges and the difference in income: vegetables definitely belong to this category. The balance of required labour and income between oranges and vegetables favoured the oranges so at present very few vegetables are grown in the central valley. Cereals and fodder also belong to this category but to a lesser extent. So today it is rare that a farmer in the central valley will plant fodder or cereals unless he raises animals and intends to use the crops to feed them.

Policies seem to have favoured the cultivation of citrus fruits. The restructuring which emerged out of the EU Reg. No 797/85 on *"improving the efficiency of agricultural structures"* (OJ L93, 30-3-85) encouraged the further expansion of oranges. Citrus and in particular varieties like Navel oranges where among the promoted crops a farmer was expected to grow as a response to Reg. 797. The basic aims of Reg. 797/85 were *"to improve the efficiency of holdings and to help develop their structures, while at the same time ensuring the permanent conservation of the natural resources of agriculture"*. With regard to the first part of the regulation, the structures of the farm holdings did develop; it is questionable however whether promoting a highly water demanding crop in an area which faces already serious problem of water quality and availability contributes to *"ensure the permanent conservation of the natural resources of agriculture"*. Some of the help available through 797/85 and from which the Argolid benefited are: group farming improvement plans (Art. 2), young farmers (Art. 7), farm improvement plans (Art. 2), support to less-favoured areas (Art. 13-19), launching aids for group farming (Art. 10) etc.

The EU policy of price support for oranges seems to be considered by the farmers as a natural guarantee, so that they grow more and more oranges. (see also Chapter 6). In the case of overproduction, the farmers receive compensation *"to use the crop for non-food purposes"* (in practice this means they are ploughed-in or left to rot). There is also the measure by which the farmers receive financial compensation for *"free distribution of the crop to charitable organisations, schoolchildren, free distribution to prisons, children's' holiday camps, hospitals and old people's homes*". (Reg. 1116/81. OJ L118, 30-4-81).

One striking conclusion is that although the problem of water salinity appeared almost simultaneously with the introduction of oranges and their early expansion, the policy-makers , initially the Greek and later the EU ones, did not make any effort to discourage the expansion of highly irrigated and irrigation dependent crops. On the contrary, we have the phenomenon of policy encouraging irrigated agriculture with the support and funding of expensive technologies and the discouraging of the traditional non-irrigated crops of the area (vines, tobacco).Similarly, during the last fifteen years, the policies applied in the area (CAP) do not seem to take into account the individuality of the area and the particular environmental problem that the area is experiencing.

5.8 The success of oranges

It has been seen that the area has experienced the almost complete disappearance of two crops which were widely cultivated, apricots and lemons. This is a useful reminder of the consequences that can arise from the vulnerability of monoculture to pests, diseases or climatic extremes (Altieri, 1987).

During this period (1960-1995) orange trees have managed to survive pests and diseases. However one pest which threatens orange trees has appeared in Greece, and the Argolid. This is a disease caused by the insect *Aleurotrixus floccosus* which if a widespread epidemic occurs, will put the whole valley under threat. The crop is also seriously threatened because of the long term effect of accumulated salts in the soil.

The following Figure 5.7 summarises the reasons why orange trees have had a distinct success in the area:

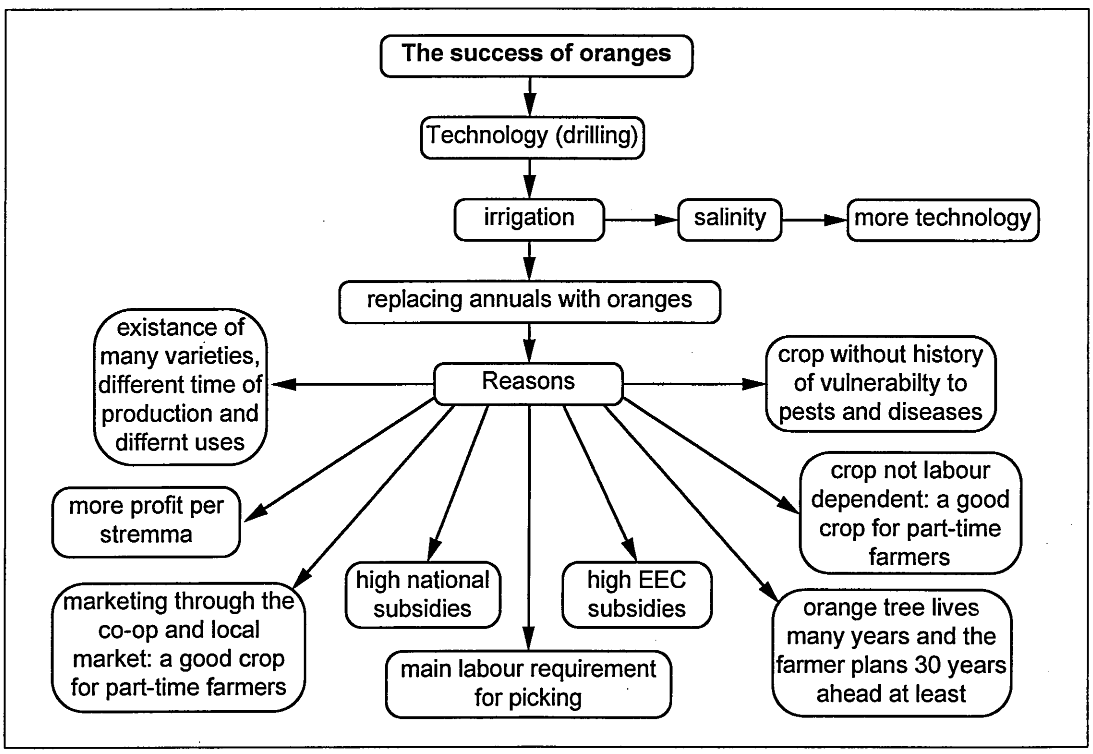

Figure 5.7: The success of oranges

5.9 Conclusions from the examination of the biophysical system in the Argolid

If crops for a more sustainable agriculture were to be suggested in the Argolid, there are several important factors which need to be taken into account. The water problem of the area is a critical factor which determines what could be considered as a sustainable crop. If new crops are to be proposed for the area one important element of sustainability is that they should not be water dependent and that they should be salt tolerant. The first factor applies especially in the periphery which suffers seriously from water depletion. The main valley can apparently solve its irrigation problem with water from the canal of Anavalos. However, this water adds salts to the soil in the long term and cannot be considered as a sustainable option.

The distinction between the main valley and the periphery underlines the need for zoning the area and not applying a homogeneous crop policy for the whole valley. One distinction arises because of the water regime and another comes from the different textures of soils. The suggested crop patterns in order to contribute to a sustainable agriculture should take the soil and water variability into account.

Regarding the climate, the particularities of the Mediterranean climate need to be carefully considered. One important factor is the uneven distribution of rainfall. Attention needs to be paid not only to average precipitation levels but also to the monthly ones. This way, fact that on average there are five months with rainfall and the rest of the year is dry is acknowledged.

The same is true of the temperatures. One should not consider average temperatures only, but their distributions as well. The reason for this is that the frost days need to be taken into account because they are critical for plant growth. In theory, the whole main valley could be supplied with expensive air-mixers. The question which arises however, is how sustainable an agriculture would be if it is dependent on external inputs and a highly technical infrastructure ?

The following chapter(s) will examine the socio-economic and political part of the agricultural system in the Argolid, thereby completing the application of the generic framework to the area. Prior to this the main biological physical and technological changes which have occurred in the area are summarised in Tables 5.6, 5.7 and 5.8 below.

1950-1960	expansion of the cultivation of oranges
1960	appearance of the salinity problem in Assini
1960	beginning of the expansion of apricots
1960-1970	expansion of the salinity problem into the whole central valley
1960-1970	appearance and expansion of *Deuterophoma tracheiphila* which led to the uprooting of all the lemon trees of the area.
1980-1990	change of crops (introduction of new varieties of citrus) through restructuring project
1987-1993	appearance and expansion of the Sharka virus. Uprooting of the majority of the apricot trees in the area.
1990	appearance of *Aleuritrixus floccosus*
1990-1992	uprooting of vines (EU policy)
1992	uprooting of tobacco (EU policy licences)
1992	introduction of Salustiana oranges, a variety for juice, (EU).

Table 5.6: Biological events

1960	appearance of salinity problem in Assini
1960-today	the farmers complain about a big frost problem. They link it with the cultivation of oranges and claim that it did not exist before.
1960-1970	expansion of the salinity problem in the whole central valley
1967	beginning of the construction of the canal of Anavalos
1987	frost of 1987 which destroyed many olive and orange trees
1990	problems of water scarcity appear at the periphery of the valley
1992	beginning of recharging of the aquifer
1992	depth of drilling in peripheral areas reaches 420m.
1994	end of the construction of the canal
1992-1994	two years of heavy drought. The area faces serious problems of scarcity of water. Intensive drilling. Problem of drought in the periphery
1995	extension of the canal of Anavalos for it to be used for recharge and not for irrigation

Table 5.7: Physical Events

1960	Introduction of drilling technologies. Transition from wells to boreholes Starting pumping depth was 20 metres. Actual pumping depth 420 metres. Transition from a rainfed agriculture to an irrigated one.
1967	The first air-mixer is established in Pyrgella
c.1980	expansion of air-mixers
1980	Deepening of already existing boreholes
1981	Expansion of sprinkler irrigation, widespread in the periphery, to a lesser extent in the central valley because irrigation is with the flood system
1981	Use of sprinklers for protection against frost
1990	Isolation of salinated boreholes, it depends upon the good will of the farmers as to whether to adopt it or not
1992	Introduction of recharging of the aquifer at an experimental level
1995	Generalisation of recharge in the central valley

Table 5.8. Technologies

Chapter 6

6. The socio-economic and political system in the Argolid

6.1 Introduction and Method

While the previous chapter dealt with the biophysical and technological parts of the framework for the Argolid, this chapter considers the socio-economic and political aspects of crop choice. The point that this chapter seeks to make is that crops that may suit a particular environment from the physical-natural point of view, may not be adopted because of administrative, political or economic influences.

Similarly, an examination of the farmers' characteristics helps to understand under which conditions they might adopt an innovation or change (in this case a change of crop). The farming culture will be examined in depth for the area, in a historical perspective, to identify the conditions under which it has emerged. Examples representing the different perspectives on farming culture will be included. These are taken from the thirty semi-structured tape-recorded interviews carried out during the First Phase of the Archaeomedes Project. (See also Sections 1.2.2 and 5.1). Their purpose then was "to identify the most salient attributes of farmer decision-making" and to provide information "on the farmers pre-occupations and agendas for change and decision making" (Allen et. al., 1994). They included interviews with farmers and local key actors, e.g. members of co-operative boards or members of local administration. Since it was not easy to contact farmers privately and during the day time they were busy working on their farms or in other non-farming occupations, the majority of the interviews were undertaken during the evening in local cafes.

Similarly, the fact that the researcher is a native of the area and has worked as an agronomist of the Service of Agriculture in Nafplion, contributed to a good knowledge of the area and its farmers. This knowledge was also used to help design the format for a subsequent more structured set of interviews with over 200 farmers in the area . These were undertaken by the researcher for the Archaeomedes project and provided information about water use, technologies employed etc. by the farmers and the constraints and uncertainty that they felt that influenced their decision making. Also, because of this knowledge and experience the researcher was asked to "role play" respondent farmers and this resulted in "reshaping of the manner in which key ideas were to be presented to the respondents" (Allen et. al., 1994). The qualitative analysis of the interviews combined with this "role playing" approach, emerging out of own experience and knowledge of the researcher contributed to the creation of the decision trees in the end of Chapters 6 and 8. (See also Section 1.2.2).

These field work exercises supported the development of a typology of farmers which represents the major farming types of the area, in terms of their differences for crop choice and decision making.

6.2 Mapping the farming society of the Argolid

6.2.1 The small size of farms:

Farms in the Argolid, as in the rest of Greece, are small compared to the average size of farms in the other EU countries (Lianos and Parliarou, 1992).

The average size is 37 stremmata[1]. As it was mentioned in Chapter 4 the size of farms needs to be taken into account by the policy maker because it can affect the decisions of the farmer regarding which crop to grow, and how to grow it. Another factor for consideration in the Argolid is that the farm ownership is usually dispersed in several plots often spread over several communities.

There are political, socio-economic and cultural factors influencing the size of the farms. Interviews for Archaeomedes suggest that inheritance law and the dowry system are mainly responsible for this (See also Forbes, 1976). The roots of this lie in the period of the Greek Revolution against the Turks in 1821. In the early years of independence (after 450 years of Turkish rule), about half of the cultivated and

[1] 1 stremma= 1/10 hectares.

potentially cultivable land was in State ownership and a considerable part of the remaining belonged to the church (Thompson, 1963; Kofiniotou, 1892).

One of the first decisions of the government was to redistribute the land to poor farmers and to people who had worked for the revolution .

> " *Previously farms were passed from one generation to the other. Proof of ownership existed only if one had in his possession legal documents, which was rare. If you go back a long time ago to see how the land was owned then you see that all these areas were once large estates. During the Turkish occupation very few people owned land. My land (300 stremmata in a mountainous area) was owned by two people 300 years ago. My father and myself own half of that. There was a mountain, two people occupied the mountain, so today we own one half. Later people bought farms from their neighbours using contracts".*
>
> *Then, farms were large private estates of a feudal type. The church was and remained a big land owner. The church was given the right to own land during the Turkish occupation: the monasteries owned big feudal farms.* (Farmer from Houni, 50 years old-October 1992).

The church still owns big farms and all attempts by the state to redistribute this land to poor landless people have failed. Farms belonging to the church and rented from it, were found in Ellinikon and Agios Andrianos. It has not been possible however, to determine the exact size of land which belongs to the church. Between the Revolution of 1821 and 1911 about 3,000,000 stremmata of church land were redistributed in Greece and the Argolid has had its own share of them.

The large pieces of distributed land was 40 stremmata for irrigated land and 80 stremmata for non irrigated land (Lianos and Parliarou, 1986). Between 1917 and 1936 a total of 17,000,000 stremmata were distributed to about 300,000 families across the country including about 150,000 refugee families from Asia Minor (Petsalis, 1948; Sideris, 1934). In the Argolid N. Kios, was created by refugees from Asia Minor and the land these people own today, was part of this distribution. Some land came from the drained marshes along the coastal strip between Nafplion and Argos.

After the Second World War, the redistribution of land continued (Law 2158/ 1952) and an additional 5,500,000 stremmata were distributed from private estates, churches and monasteries and reclaimed areas. Therefore the land redistribution in Greece has been both a political and a social process.

6.2.2 Formation of the current farming society after World War II - How the current types of farmers emerged?

Another important factor which helps to understand crop choice decisions is how the current types of farmer have emerged. Information about this was collected through two hundred interviews carried out for the Archaeomedes Project and from an examination of the literature found in the local libraries of Argos and Nafplion and the National Library in Athens. An examination of the recent history, after the Second World War, was judged to be necessary since it was found that the origin of the current farming society can be traced back to this period.

The Argolid like the rest of Greece, experienced external migration after the War. As a result of a destroyed local economy and a lack of resources, a considerable part of the rural population, migrated to W. Germany, USA, Australia and Canada. This exodus was greater in the mountainous communities, where, because of the poor quality of land, it was more difficult to make a living. At the same time the farmers started moving towards the urban centres (Spanopoulou, 1990). This was particularly evident with the mountain villages around the valley.

According to the farmers who were interviewed there are villages in the Argolid which were formed after 1950. One example is the village of Statheika. This was formed by shepherds who came down from the mountain village of Vrousti and bought land in Statheika, Koutsopodi and the periphery of Argos. Elliniko is another community close to Argos which was recently formed by shepherds and farmers coming from the surrounding mountain villages. Most of the farmers in these villages tend to be full time. While the farmers from the mountains descended to the hills, the farmers from the central valley started moving to the local urban centres (Argos and Nafplion) with a further exodus abroad and towards Athens.

The movement of the agricultural population towards the urban centres coincided with the increased labour requirements of the public services and the construction sector. The exodus continued until 1970 when it slowed because of increasing unemployment and the poor quality of life (Moissiadis, 1985). The farming population, now tend to remain in the villages however in order to make a better living they often take secondary jobs like tourism or working in the fruit processing factories.

25% of the farms are less than ten stremmata. Apart from a few cases of intensive crops (i.e. greenhouse flowers) it is difficult to make a living out of such a small size of farm. As will be elaborated later, the production of oranges has contributed to the increase in the number of part-time farmers. This is largely because it is a crop which does not require intensive labour except during the picking period.

The farmers with small parcels of land continue farming, albeit part-time and the majority of them do not consider selling the land. The reasons for this are cultural as well as economic. Possessing land adds to the status of the farmer and the number of trees a farmer owns adds "prestige" as well as extra income. However people with land of poor quality, and lack of water is a standard factor which qualifies land as low quality and consequently makes it of low value, may consider selling. People whose land is in tourist areas near the sea might also sell for a price higher than they could get from farming. In general investment by farmers in the plain (i.e. investment in urban property), from profits or limited sale of land, tends to be outside of agriculture. This is not the case with farmers on the periphery. (Lemon et al, 1995; Thompson, 1963; Lianos and Parliarou, 1986).

A farmer who migrates to a non-rural area will try to keep his land if he can because possessing land is traditionally the best insurance against economic uncertainty. Land ownership acts as a guarantee and an honour and it is considered shameful if someone sells. The psychological attachment to the land is therefore very strong (Damianos et al, 1991). In consequence, the majority of the farmers keep their small parcels.

The reparcelling process or land consolidation, which is an attempt by government to increase unit size, is therefore a difficult task. The policy of land reparcelling started in Greece in 1953 (quite late compared to the rest of Europe) and by 1988 it had been implemented in 7.3 million stremmata across the country (Reg. No. El3124, 1957).

In the Argolid farmers would not accept land of lower quality than that already owned and the nature of ownership is such that a farm is usually scattered in 5-7 parcels with each varying in quality and value. Similarly, there is a distinction between farmers who grow annuals and perennials (trees) and others who grow annual crops such as cereals and vegetables. A farmer growing vegetables for example is more likely to accept the reparcelling than someone who grows trees (oranges or olives) because the latter will consider the investment in time, effort and money to establish the crop before deciding to sell. The existence of trees adds considerable economic value to a farm (Kamenidis, 1985) in addition to strong psychological attachment to the land.

> *I would prefer to go out to work and that's what I am doing now, rather than uproot these trees. Because they are my life, they are me.* (Farmer from Pirgella, growing oranges, 60 years old - December 1992).

Therefore a farmer who owns a farm planted with trees must be in a very desperate financial situation to sell or he may presented with an offer which is too good to refuse. It has been seen that inheritance law and the existence of dowry influence farm fragmentation and in consequence have contributed to the failure of land reparcelling. The land is distributed among the children, not necessarily in equal parts. This depends on a number of factors, such as whether the child has studied and the parent has helped to pay for those studies, or the child is a boy or a girl -usually the boys are favoured over the girls (Forbes, 1976). It appears that agricultural policy-makers tried to implement land reparcelling *"without changing the law on inheritance at the same time"* and therefore the project failed (Pepelasis, 1976). The following section extends the analysis of farmers in the Argolid.

6.2.3 Full-time and part-time or multiple-job holding farmers- Farmers of the periphery and the main valley

The agricultural population of the Argolid, as in the rest of Greece, is characterised by a high percentage of part-time or multiple-job holding farmers (50% in the Argolid) and farmers whose main occupation is outside agriculture. As a rule part-time farmers are less likely to grow crops which have high labour requirements both in their production and marketing. Preferred crops such as oranges and olives can be sold through co-operative marketing structures and have relatively low labour requirements.

Part-time farming for small farmers often links farm work with the form of dependent labour in industry, tourism and construction. For larger farmers it is directed towards trade, industries, self-employed businesses or to public sector (Moissiadis, 1985; Damianos et al 1991).

While farming is considered as a low status job for many farmers, working in the public sector for relatively little money, seems to have a higher status attached to it (De Waal, 1991; Allen, 1994)

> *Farmers are the last step of the society. We are not to change cultivation, we are to change jobs. Why are there are so few young farmers? Because there are no motives. So, everybody's ambition is to work for the public administration.* (Farmer from Pirgella, 27 years old - November 1992).

The central part of the Argolid is characterised by the monoculture of oranges produced by part-time farmers whereas the periphery of the valley has a majority of full-time farmers who grow more than one crop and have a high labour commitment to farming. Due to the landscape in the periphery (hills and mountains) there are larger farms there than in the valley (Allen, 1994). However, in this area the percentage of cultivated land is considerably less for each farm. The size of the farms affects the cultivated crops and their marketing considerably. The farmers of the central valley have larger parcels of cultivated land and consequently can produce higher tonnage. The farmers of the periphery however may achieve higher income by growing early varieties (i.e. Navels instead of Merlin oranges) and other crops (vegetables or other fruits) and selling them to the local markets together with those oranges that are sold in this way.

There is a noticeable difference of attitude to farming between the farmers of the periphery and those of the central valley. The children of farmers from the periphery usually inherit the farms, stay in the village and continue farming.

> *If my child goes to university, he will go away from the village and will abandon the farms. If he studies and gets a job with 150,000 Drs per month,*

> *this is the money I earn by going to the market just once.* (Secretary of the Community of Skafidaki, December 1992).

While farmers of the central valley continue farming as a secondary occupation, they often leave the village and move to the nearby urban centres or to Athens and pay for the specialist agricultural services (pruning, spraying etc.) and the seasonal fruit pickers. Therefore these farmers have a full time occupation outside agriculture and at the same time they continue growing oranges since they do not have high labour commitment. Because they cannot devote much time to farming they are less likely to adopt a crop which has high labour requirements even if it is profitable. The full time farmer on the contrary is more likely to adopt a labour intensive crop, both in terms of its production and marketing. A part-time farmer does not have much incentive to adopt a crop which needs to be sold at the local markets which are very time consuming. On the contrary, either way of marketing -through a co-operative or local markets-does not seem to be a problem for a full-time farmer who has additional on farm family support. Some farmers do however choose not to use local markets because they wish to avoid the problems associated with acquiring a "pitch". This obviously will influence the type of crop they choose to grow.

6.2.4 Labour

It has already been seen that the statistics about the labour employed in agriculture in the Argolid are unreliable because a great part of it is hidden or illegal. Full-time farmers, generally on the periphery of the area draw upon family members as (hidden) labour (Spanopoulou, 1990).

> *Married women work the land with their husbands. Besides, men in the village are full-time farmers, they do not do another job so that women own the land. Only widows own the land officially, but I could say that women work more than men here.* (Secretary of the community of Skafidaki, December 1992).

There is also a lot of poorly paid foreign labour, many of whom are illegal immigrants i.e. Albanians, Bulgarians, Romanians. The farmers in the Argolid prefer to hire foreign labour and in particular Albanians because they are paid very low day wages while local labour costs much more. In addition, to employ local labour means farmers have to pay National Insurance contributions which makes it even more expensive. Another source of labour comes from the mountainous areas of the Argolid and Arkadia region. The villages of these areas are poor and the farmers very often complement their low income by working elsewhere. The cost of producing a crop is therefore completely different if one pays the official market wages for labour rather than employing low paid, often illegal workers.

Local labour is expensive compared to the illegal immigrants as was mentioned previously. One thing which is to be taken into account however is that the majority of the younger farmers of the main valley at least would not choose to do a farming job for an extra income. If they need another job they take it outside farming. The farmer, for instance, will prefer working as a waiter in a restaurant than going to pick fruits on another farm.

Local labour is usually reluctant to pick oranges but they are more willing to work in factories to pack and process the crop.

> *It is true that it (picking) is hard work in the middle of winter and the Greeks avoid it because they are going to become wet and cold. So, they prefer to work at the factory. There, all the staff are Greeks.* (Headman of N. Tiryns, 60 years old, January 1993).

Therefore within farming there are low and high status jobs and picking is one of the lower status jobs.

In general, a reluctance for growing crops which require a high labour commitment is observed in the area. This is obvious in the main valley, but also in the periphery where there is a high percentage of full-time polycroppers.

> *What about if people returned back to the cultivation of vegetables mainly? Would it be better or worse?*
>
> *It would be worse because they require more labour. The farmers in Skafidaki work hard by growing vegetables because it is their choice. They do not need the income from the vegetables to survive. They consider it as an extra income. Each house owns three cars plus the tractor and various types of farm machinery. They make their income from oranges, mandarins and apricots.*

They make some extra income from olive oil too. Meanwhile, they cultivate cabbages, lettuces and beans because they can sell them with the oranges at the market and make an extra income. (Secretary of the community of Skafidaki, October 1992).

6.2.5 Age of farmers

In the Argolid as elsewhere in Europe there is an ageing farming population (Damianos et.al, 1991). Most farmers in the area are over forty and the average head of farming households exceeds fifty five. Older farmers are less open to innovations and they are less likely to take risks than younger ones (Ilbery, 1985). While their knowledge and experience is very important to them they are not open to new practices. This is particularly evident if change includes abandoning perennial crops i.e. oranges in which they have invested heavily over many years.

As was mentioned in Chapter four, the older a farmer, the more risk averse he is likely to be. One reason for the failure of many projects, is that they only take profitability into account when considering the adoption of a crop or other innovation, and they completely ignore the farmers' attitude towards risk. It is easier for a farmer to accept an innovation if it involves a switch from one annual to another, he does not have to take into account the loss of income because of the time for the crop to reach full production (which is the case with fruit trees) and has to see an actual, real life example of an innovation (i.e. by a neighbour). He is unlikely to evaluate the new crop just from the information given by the local agronomists or other sources of information.

There has been an attempt to reduce the number of elderly heads of farming households, through the EU's CAP which includes early retirement for farmers who are 55 and over (R797/85). Through this regulation, the younger farmer who takes over the land is subsidised and the older farmer receives compensation either in monthly payments or in a lump sum (Fennel, 1987). The system has been considered of limited success for many reasons e.g. the compensation given to the retiring farmers was considered too low and it was difficult to find younger farmers who would take over the land (Spanopoulou, 1990).

6.2.6 Different levels of education

The education of a farmer may be an influential factor over the adoption or rejection of a crop. Twenty or more years ago, the majority of the farmers in Greece had a low level of education; (primary school mainly). Today, however the majority of farmers have finished high school (8 years of education-the equivalent of GCSE) and there is a smaller percentage who have finished Likio (the equivalent of A-levels) and a minority with University or Postgraduate education. The most common group is the Union of Young Farmers (E.N.A) in the Argolid.

The Young Farmers were formed in 1990 and are well organised. They have access to information about EU and National Policy; they can use computers and data bases, travel around Europe, attend conferences and exhibitions and are in touch with other farmers unions in Europe. They also have wide environmental concerns and organise seminars about the various local issues.

After joining the EU, to take advantage of the various EU structural projects, (i.e. 797/85), the farmers are expected to have an appropriate level of education to keep accounts and understand the EU guidelines properly. This is a restrictive factor limiting the opportunities of the farmers who cannot assess this kind of information themselves and rely on the local agronomists of the Service of Agriculture to help and inform them. (See Figure 6.1).

On the other hand, there are crops which require that farmers have specialist knowledge (i.e. greenhouse flowers and specifically roses). In this case, the farmer is expected to have a good knowledge of economics so that he can deal with the complex accounts of the enterprise. Also, a knowledge of at least one foreign language is recommended since most of the production is exported .

Consideration of the education of farmers is an important factor that the policy makers should take into account. Similarly the kind of information that a farmer needs in order to consider adopting a new crop must also to be considered.

6.2.7 Information and farmers

The following diagram represents the main sources of information for the farmers of

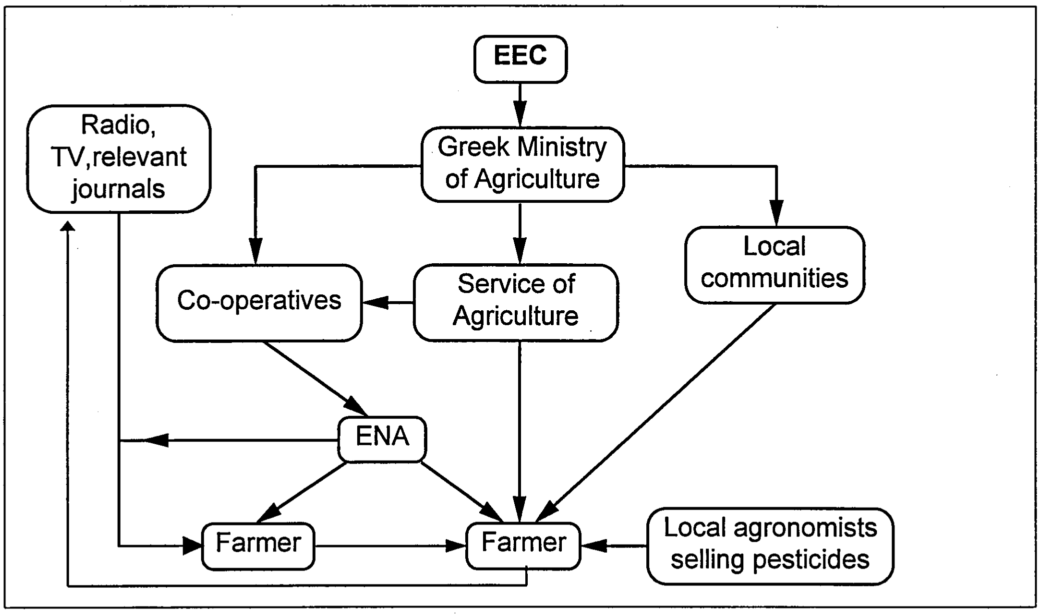

Figure 6.1: Sources of information for the farmers of the Argolid

the Argolid.

One direct source of information for the farmers is the Service of Agriculture. It is through the Service of Agriculture that the European and national policy reaches them usually. The agronomists of the Service of Agriculture who have direct contact with farmers are responsible for information and for ensuring the correct implementation of these policies.

However, as concluded from the Archaeomedes study, the agronomists are considered too busy with their administrative tasks so they do not really have the time, the knowledge or sometimes the desire to help. The Service of Agriculture organises seminars for the benefit of the farmers and publishes brochures and leaflets which are distributed to the farmers and to the local communities' offices. It seems however that direct contact between the agronomist and the local farmer works better and is desired.

The main centres where farmers exchange information are the local cafes in the villages to which the farmers go almost every evening as it was found from the Archaeomedes project. It seems that they are the best places for delivering and exchanging information of all sorts. One problem is that the agronomists of the Service of Agriculture are public servants, therefore they work from 7 am to 2.30 p.m., the same times that the farmers are in the field and therefore less able to contact the Service. This is less of a problem for part-time farmers, particularly those who are employed in the towns.

The media (TV and Radio) are another source of information but a limited one with some local radio stations including programs of specific interest for farmers.

Private agronomists selling pesticides and fertilisers also provide information. However, according to the farmers they are characterised as "dealers" and the advice they give is biased because they are most interested in selling.

> *Since they are dealers, they show interest for the farms. While, the agronomist from the Service, who is a neutral person, he has no interest from pesticides could give you an economical solution with pesticides which would have the same good results and would cost less.* (Farmer from Pirgella, 60 years old, October 1992).

Finally, the local co-operatives for marketing the crops and the community offices provide good sources of information for the farmers, especially the latter. Union of Young Farmers (ENA) is an important source of information since they organise workshops, seminars and training courses in order to make the farmers and the general public informed about topical subjects e.g. the degradation of water resources of the Argolid, the role of pesticides, the case of unemployment of young farmers.

6.3 Economy of the area

Greece has been a member of the EU since 1981. Agriculture in the Argolid is directly affected by the CAP and subsidies and price support have affected the decision-making of farmers.

> *Question: If tomorrow morning subsidies stopped, would this influence the farming tactics?*
> *Answer: Subsidies play a very important role in farming. In that case, the farmers would have to move to the towns. There are many farmers who go on farming because of the existence of subsidies i.e. the farmers who grow olive trees.* (Headman of Elliniko, 55 years old, February 1993).

One of the reasons for the expansion of oranges has been the introduction of various schemes through the CAP i.e. subsidised exports for the crop, infrastructural assistance, compensation for withdrawal of specific crops in case of overproduction, (Fennell, 1987). There are also supported options for selling the crop i.e. compensation for dumping, social withdrawal for schools, the elderly, prisons, etc. (Fennel, 1987) .

6.3.1 Co-operatives

Most farmers in the area are organised in co-operatives and groups of producers[1]. Entrance to the EU encouraged the expansion of co-operatives and the development of producer groups providing financial support. The existence of co-operatives particularly helps to overcome the problem relating to the small parcels of land. In this way, the farmers of 10 or 20 stremmata of land can export their products at competitive prices.

[1] (Art.14.1 of Reg. 1035/72, amended under Reg. 3284/83 (OJ L325, 22-11-83).

Most of the orange crop in the Argolid is exported finally to countries of Eastern Europe and there is a network of dealers who act as intermediaries for these exports. The farmers in the interviews complain about the uncertainty which arises from slow payment, often at levels below those originally agreed. Some co-operatives are attempting to overcome this problem by operating as dealers. The co-operatives are responsible for picking the crop, its quality control, the application of chemicals and its transportation to the harbour or railhead. Prices agreed through the co-operatives tend to be lower than those that can be achieved through the local markets, however there is less uncertainty attached to the sale . A variation of price exists for the oranges sold through co-operatives depending on the individual contract through which they are sold depending on whether they are early or late oranges. The latter usually have higher prices.

Marketing is critical for the adoption of a crop. It seems that the farmer would prefer to grow a crop with a well-established market and smaller profit instead of a promising new crop for which there is no clear information about its marketing. Finally, it appears that the organisation of farmers in co-operatives is necessary because of the small farms and level of part-time farming, both of which restrict the production levels and benefit from the opportunity to market collectively.

6.4 *The public administration which affects the water in the Argolid*

One of the factors which needs to be considered before reaching conclusions about what constitutes a sustainable crop choice for the area is the role played by politics and political agencies and how they affect everyday life at all levels. The role played by political will in the realisation of a project and the influence of politicians, particularly at a local level, are very important influences on the decision making of farmers. For example, the political deputies are the persons that a farmer will try to approach when he has a problem that the local headman cannot solve. It is the norm to do favours for the people who elect them and who vote for their party (Rousfeti[1]), and an essential part of the political game played in Greece (The Economist, 1996). This way they can be sure that they are going to be re-elected.

Similarly it seems that at all levels of public administration, personal contacts are extremely important and influence the distribution of information. In addition to this, every time that the government changes, most of the senior posts change hands with it. The agronomists are not an exception. So every time that elections are held the directors of the Service of Agriculture change at a local level as a result of changes at higher levels of the hierarchy. The agronomists who are active members of the previous party change posts irrespective of whether they are in the middle of a project, or they are experts in a particular subject. This expertise may not be used in their new post.

> *"I would like to tell you something else; each party which comes to government instead of increasing the personnel, (of the Service of Agriculture) is making it redundant After a certain period it gives work to "its"*[2] *agronomists who have the qualifications but not the experience. They dismiss an agronomist with 15 years experience and replace him with a new one."*
> (Farmer from Houni, 50 years old, October 1992).

As a result of these changes, chaos often occurs in the public administration. The agronomists being poorly motivated as a result of precarious positions and low salaries have a good reason for a poor quality of work. For an anthropological discussion of the role of public administration in contemporary Greece, see Heerzfeld, 1992.

The deputies are the final recipients of important matters in the region and they are the ones who can represent the farmers at the Parliament. What happens with these matters and how many of them are promoted and solved depends on how active the

[1] Rousfeti: a word of Turkish origin denoting the reciprocal dispensation of favours. (The Economist, June 29th 1996).

[2] Its agronomists: the ones who are politically affiliated with the party.

deputy is and then if he is a member of the governing party or he belongs to the opposition.

Deputies of the governing party usually have access to greater funds compared to the deputies of the opposition. The same happens with headmen and mayors.

> *I founded a group of producers with the name "Pyramid". During the eight years of PASOK*[1] *the group was disliked . This is because the members of the group supported the Right (N.D*[2] *). We were punished by PASOK, we did not receive EU subsidies, entitlements etc. Funds for the community were also lost in this period.* (Headman of Helliniko, 55 years old, January 1993).

6.4.1 Agencies and agendas

The problem of degradation in the Argolid is largely perceptual and depends upon who is defining it. There are various interpretations about the same issue i.e. a farmer, a deputy, a researcher, a policy-maker, a politician. All the people involved and affected by the water problem have not managed to sit and talk together so that they can see the matter in its full dimensions. There are various different agendas, often partially known to the actors involved. Another problem is that the persons involved from politicians to farmers seem to deal with the problem in the short term. The major concern of the deputy for instance seems to be how he is going to be re-elected in the next elections. In order to achieve this he has to be popular and promise various things which could solve the problems of the farmers.

> *Q: During the last ten years we have had two governments, could you say when things were better?*
>
> *A: I do not see any change. Both of them before the elections care about the farmer, but afterwards they abandon him. "The villages are abandoned by all the governments. Our members of Parliament have disappeared for four years,*

[1] PASOK: Pan-Hellenic Socialist Movement.

[2] ND:. New Democracy-the Conservative Party in Greece.

but now that elections are near, they will appear again". (Farmer 45 years old, member of the board of the Airport Co-operative in Argos, January 1993).

The politician is not going to be popular if he tries to stop the environmental degradation by telling the farmers of the periphery that there is no chance for the Anavalos canal to reach their villages and as a result they should not plant oranges and uproot their existing ones. The deputy is expected to satisfy the people's requests.

Nobody has informed the farmers of the extent that the supposed "panacea," the water of Anavalos is already salty and therefore it will add salt in the long-term. Research undertaken by Universities and Research Organisations also has a political colour and it is unlikely that the universities working on the matter would jeopardise their grants by telling farmers about the possible disastrous consequences of their current farming practices.

6.4.2 Research organisations

Most of the research done in Greece is financed directly by the various ministries with national or FEOGA[1] funding. A map of the Research Organisations working in the Argolid in relation to the political organisations from which they are financed is described in Figure 6.2 and the role of the above research organisations and their interests follows in Figure 6 3.

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[1] FEOGA: Fonds europeen d' orientation et de guarantie agricole: the mechanism through which the CAP is financed. It was set up in 1962 under Regulation No. 25 *on the financing of the common agricultural policy. (Fennel, 1987).*

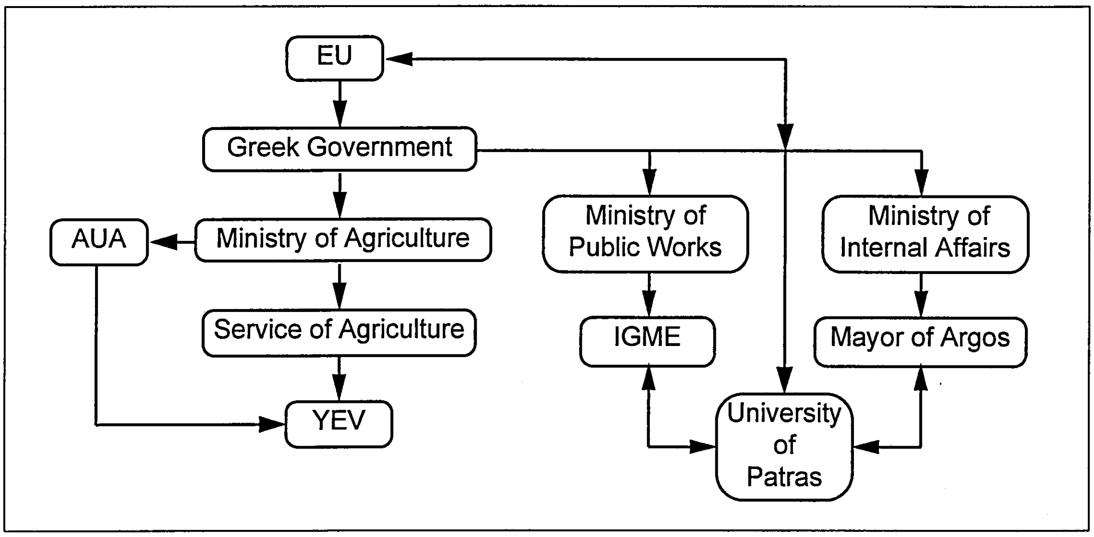

Figure 6.2: Research organisations and their relationship with political institutions

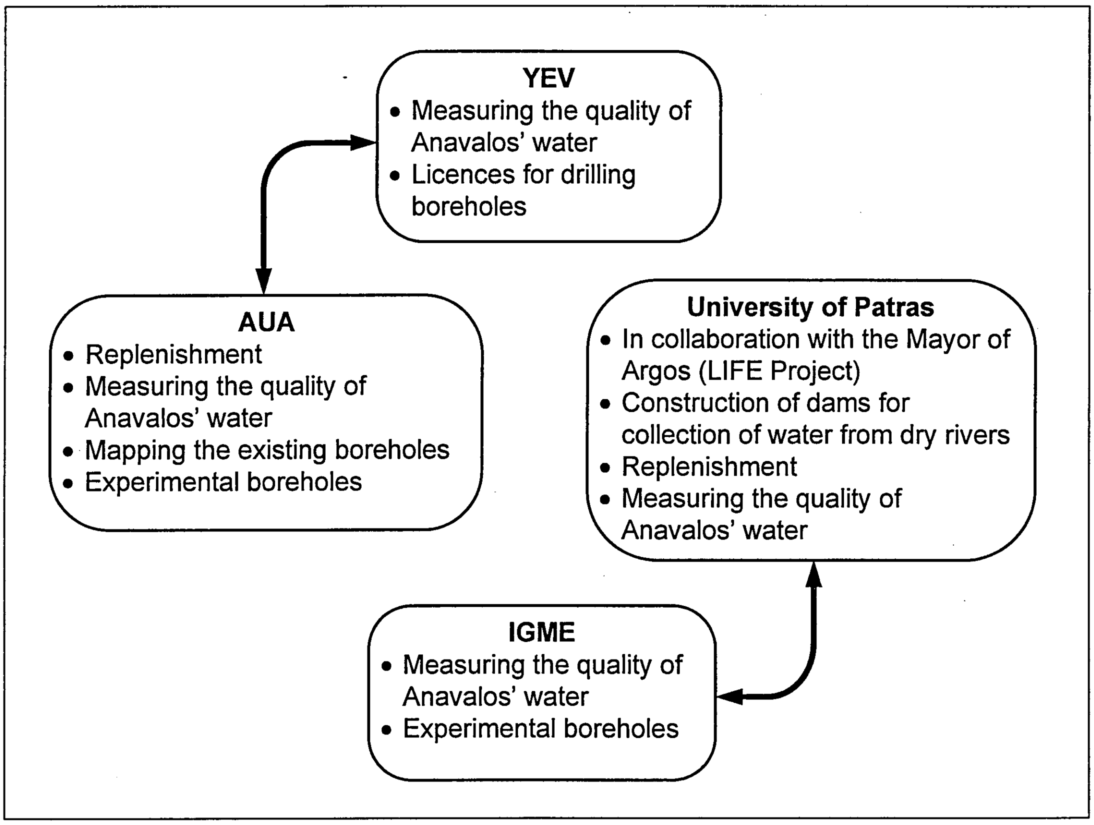

Figure 6.3: The main research organisations and their projects

As can be seen from the diagram four organisations measure the quality of water of Anavalos. They are the AUA, IGME, University of Patras and the YEV[1] . However they don't reach the same conclusions about its quality. (Hemerida, 1992).

The University of Athens co-operates with YEV and they exchange data and the University of Patras collaborates with the IGME. However as it was concluded from the Hemerida (Workshop) organised by the local agronomists, (1992) there is no form of relationship between AUA and IGME and AUA and University of Patras.

[1] AUA: Agricultural University of Athens; IGME: Institute of Geological and Mineral Research; YEV: Service of Land Reclamation.

6.5 Conclusions

In this chapter, the socio-economic and political subsystems of the generic framework have been applied to the Argolid. Some critical variables which affect crop choice were identified. They are going to be summarised and the conclusions will be presented in the form of decision trees for the different types of farmers, types of crop and areas of the valley. Before presenting the decision trees, a selection of responses from the farmers to the question whether they would grow another crop and under which conditions are provided in Figure 6.4. A clear distinction has been identified between the main valley and its periphery. These areas are different from the physical

- *People would change when they would have a good motive to do so - a good subsidy so that they can replace the income they loose, for 5 years at least. The new crops would be adopted provided that there is water of course.*
- *People did not adopt the suggested pistachio and fodder instead of the uprooted apricots because they do not know the characteristics of the plants. They don't tell the farmer:" if you plant these plants you will have x Kilos per stremma and x Drs per Kilo.".*
- *Suppose that tomorrow there would be no water, we would become Sahara desert and the people would become Albanians. They would go back to growing cereals.*
- *Apricot trees expanded as a result of the law of supply and demand and because they are not as demanding in water as the orange trees.*
- *If there would be a suggestion to uproot orange trees and plant vegetables, the amount of existing water does not cover us. To plant grapes, it is okay. Even if you irrigate them twice a year, they are fine.*
- *The oranges replaced the previously grown vegetables for one main reason: the vegetables needed a lot of work.*
- *I cannot change (uproot the oranges), I am 46 years old what else can I do?*
- *I believe that in our area there are not many crops which could be cultivated. Lemon trees are good but uprooted because of Coryphoxera. Early apricots do not exist anymore because of Sharka, so we have oranges, mandarins, the new varieties of lemon, olive trees and late apricots.*
- *If a farmer wants to plant a crop, he will ask the agronomist, but his own opinion is more valuable. He will ask the opinion of another farmer too. Or he will see how somebody else is doing who planted the same variety.*
- *If subsidies would stop tomorrow, farmers would have to move to the towns. There are many farmers who go on farming because of the subsidies, e.g. the olive producers.*
- *In general, I don't listen to what somebody else tells me to plant in my farm. I plant whatever I like.*
- *Gentlemen, what do you want me to grow? Give me the means to do it. Somebody must take decisions for the farmer and this is not done by sitting in an office.*
- *It would be very difficult to change cultivations because all the nutrients are taken from the soil. To plant what? Cotton? It would be a failure. Cereals? The farmer takes 50 Drs/Kilo and bread is sold at 300 Drs/Kilo. Tomatoes? They cannot survive here. Vegetables? the same. The only thing that could replace oranges is flowers and greenhouses in general.*

Figure 6.4: Farmers' statements regarding changing crop

(soil, water quality and availability and size of farms) and socio-economic (difference of percentage of full-time and part-time farmers and difference in attitude regarding commitment to farming) points of view. In conclusion it cannot be expected that the farmers will have an homogeneous response to the suggestion of a new crop and to changes in existing crops and farming practices. The final section of this chapter will

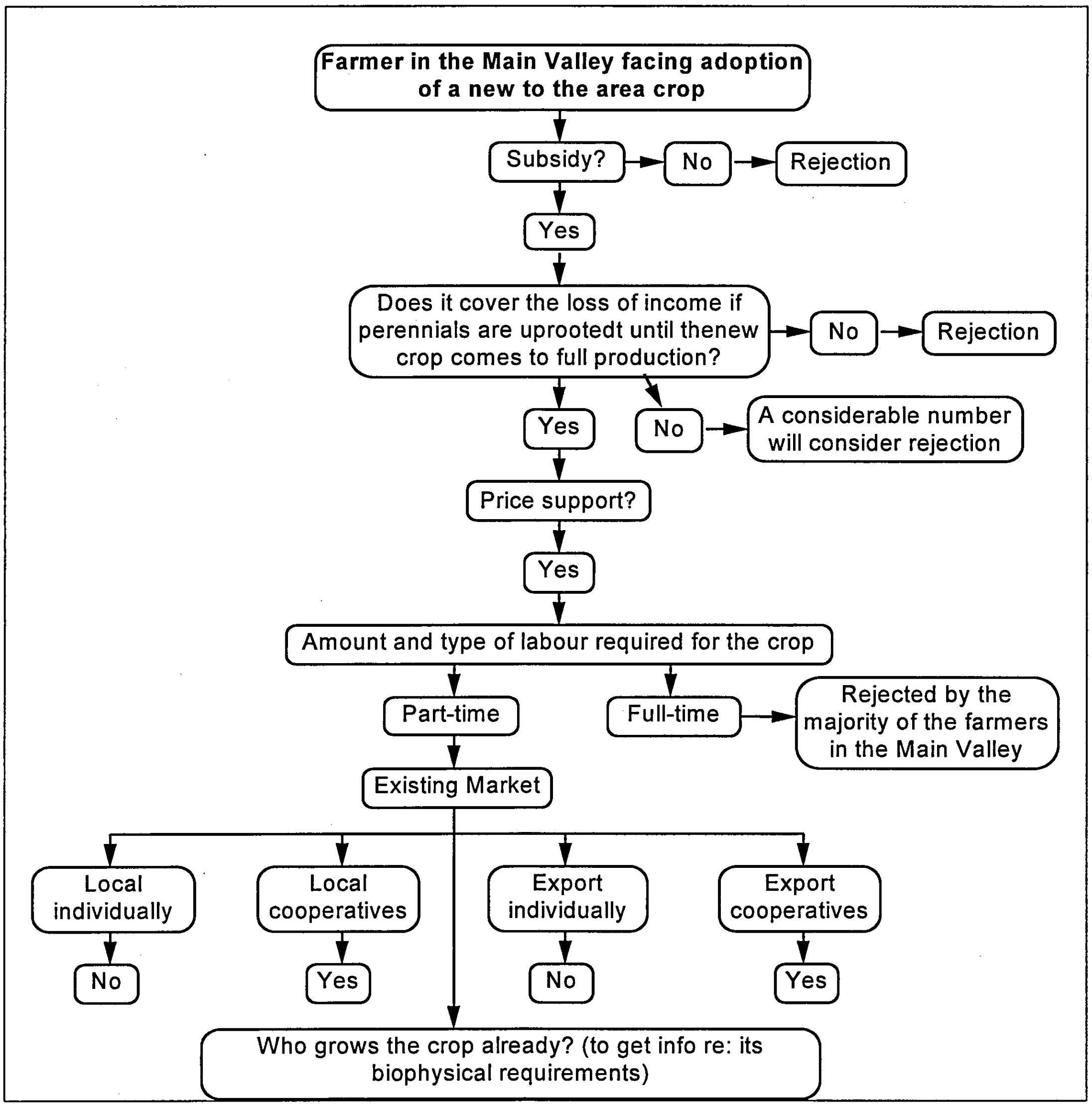

Figure 6.5: Decision tree regarding the adoption of a new crop in the Main Valley

present some of these responses in the form of decision trees. As was mentioned in the introduction of this chapter these decision trees were created as a result of the analysis of the semi-structured interviews obtained by the farmers, application of personal knowledge and use of a "role playing" approach.

When the decision making of the farmers is examined regarding the adoption of a new crop to the area one can see that the existence of a subsidy[1] is crucial and is a priority in determining farmers' preferences. Similarly, labour and the required commitment to farming in general have a very important place in the decisions of the farmers. The majority of the farmers of the main valley who are part-time farmers and monocroppers, are expected to reject a suggested new crop before considering its profitability if it requires full-time labour. If the crop requires part-time labour, it may not be adopted if the marketing also requires a high personal commitment from the farmers. These three issues are very important and compete with profitability in farmers criteria.

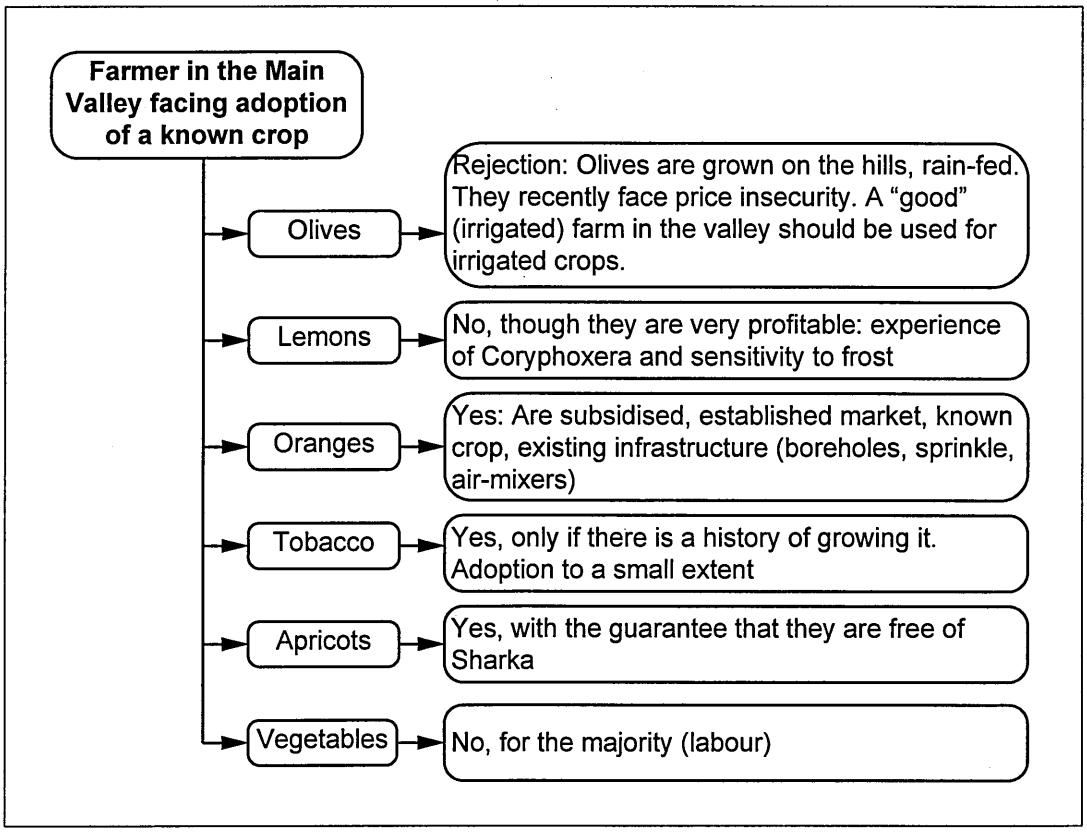

Figure 6.6: Decision tree regarding adoption of a known crop in the Main Valley

When the adoption of a known crop to the area (the main valley) is examined, the following conclusions can be drawn: (Figure 6.6). The farmers may reject some existing crops for various reasons, i.e. vegetables: because of the required labour for their cultivation and marketing; lemons: because of their bad history and sensitivity to

[1] Subsidies act as production support, while price support provides a guarantee of market for a crop.

frost and diseases; apricots because of their record with pests and diseases; olives are no longer profitable and the farmers consider that if there is water available it is a waste not to plant an irrigated crop; tobacco, was only grown under licences and these are now been withdrawn. So, from the already known crops, the crop that the farmers would be willing to grow, seems to be oranges only.

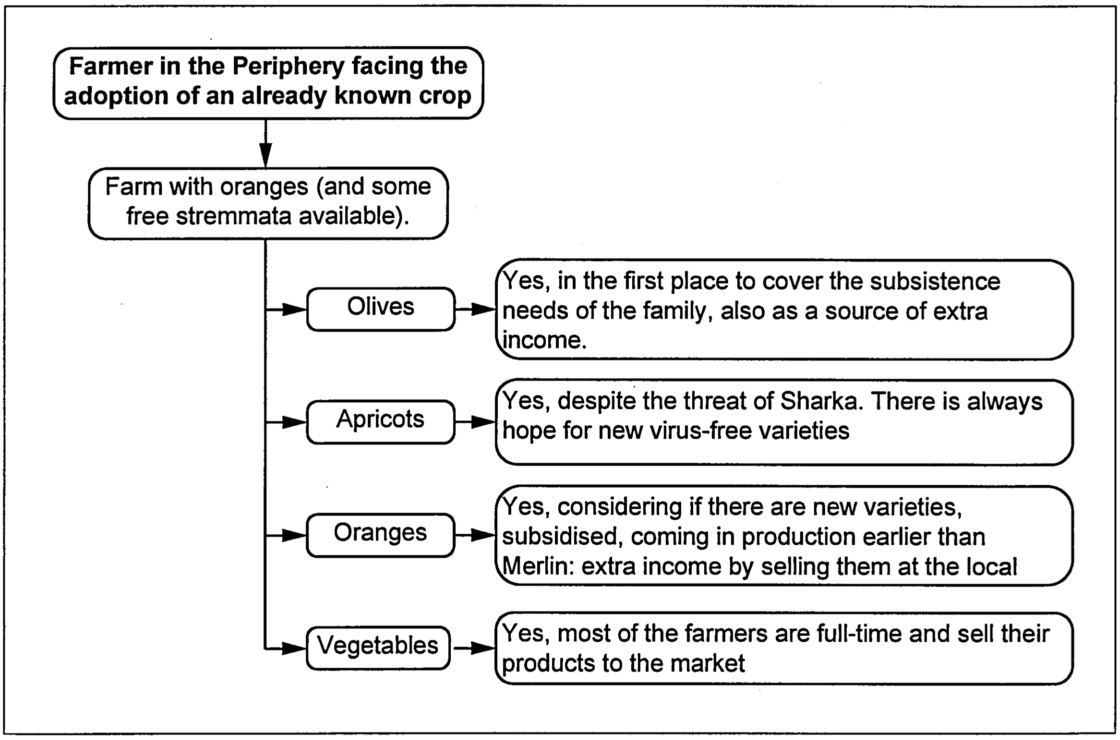

Figure 6.7: Decision tree regarding the adoption of a known crop in the Periphery

When the adoption of a known crop in the periphery is considered, and compared with the main valley, the following conclusions can be drawn.

The farmers of the periphery, seem more willing to adopt a wider variety of crops compared with those of the main valley. These farmers are not monocroppers and they already grow two to three distinct crops per farm. Also, they tend to be full-time farmers with a high commitment to farming and as such can adopt a crop which has high labour requirements for production and marketing. When considering changing cultivation, these farmers may be willing to replace one of their existing crops, however they are unlikely to replace all of them one time.

It would appear that the role of subsidy and price support is not so critical for the farmers of the periphery as it is for those of the main valley. In this case water may

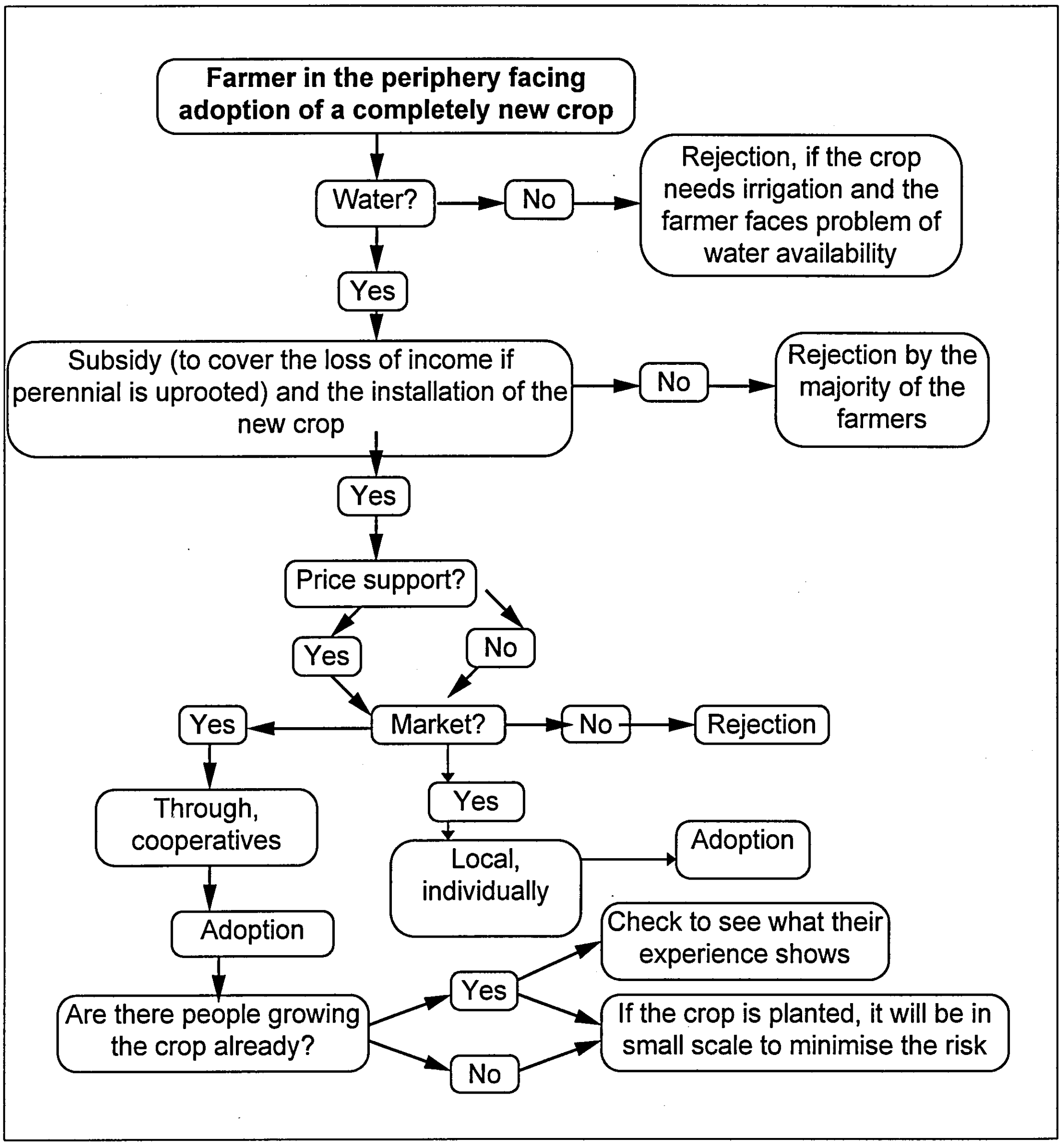

Figure 6.8: Decision tree regarding adoption of a completely new crop in the Periphery

well be a more influential factor in conjunction with the existence of a local market. As was mentioned previously, for them agriculture and the farm constitute their basic activity and the main source of income. These farmers *"do not farm for a subsidy"*. When the market is considered, the type of market, is not a restrictive factor for the adoption of a new crop as in the main valley. On the contrary the farmer of the periphery will ask if there is any market at all and he will not be highly concerned about the type.

The farmer of the periphery, having less restrictive factors than the farmer of the main valley, will be willing to learn from the example and experience of other farmers about alternative crops. In addition it seems that the preferred way of getting information is through this example and not through official channels of information: i.e. Service of Agriculture.

The criteria which have been established in the generic framework for crop choice and applied to the Argolid will now be considered regarding a potential crop, greenhouse roses.

Chapter 7

7. Examination of roses as a crop from the biophysical-technical point of view

Chapters 7 and 8 deal with the biophysical and socio-economic requirements of roses respectively.

When a crop is grown in a greenhouse, the emphasis given to the various biophysical factors affecting its growth is not the same as if it were grown outside. This is due to the "artificial" conditions that can be created. Similarly, various forms of technological infrastructure can contribute to favourable changes of the environment in which the plant is grown. There are several factors which have to be studied to assess how suitable a crop is for growing under greenhouse conditions (Efstathiadis, 1987). This is exactly the approach which was followed here with roses after a literature review was undertaken. The method adopted for the case study and the reasons why the particular crop was chosen are discussed in Section 1.1.3 and will be discussed in more detail in Chapter 8. The factors which will be examined in this chapter are:

- the physiological characteristics of the crop
- the variation in flowering
- the choices available concerning cultivation techniques
- plant life cycles
- the economic possibilities of the crop
- the economic and the technical[1] knowledge required by the grower.

7.1 Special demands of roses

1. Roses have a low resistance to high temperatures and cannot photosynthesise at temperatures higher than 32°C.

[1] Much of the information regarding the technical requirements of greenhouse roses for Greek conditions was derived from the Journal Yeorgiki Technologia , Vol. 4, 1990 (In Greek).

2. The roses have a high evapotranspiration. The optimum relative humidity for the crop is 70%. When it is lower the leaves suffer a permanent deformation, and the damage to the flowers is considerable: change of colour etc.

3. The rose is very sensitive to abrupt changes of climatic conditions.

4. Roses show a high sensitivity (more than any other crop) to pests and diseases (e.g. *Tetranychus*, *Oidium*) the expansion of which is directly linked with the low relative humidity (40-50%)

The rose is a perennial crop: it is grown in a greenhouse for an average of seven years and is therefore exposed to the changes in weather of all the seasons. This means that the influence of weather conditions can become serious (Damagnez, 1975).

The characteristics mentioned above underline the need for a cooling system so that the temperature inside the greenhouse is lower than the external one. This system needs to be combined with shading of the greenhouse so that the cooling system works more effectively. So, the two basic systems that a greenhouse with roses must have are shadowing and cooling systems (Grafiadelis, 1980).With these, the roses are protected during the hot period from high temperatures. In addition to this, a good combination of these two systems helps to organise the greenhouse so that the maximum possible profit can be made during the winter from the sun's energy. This is very important considering that it is during the winter that the prices of roses are higher and it is then that the cost of heating constitutes the main restrictive factor on the profitability of the crop.

7.2 The cooling system

There are two main types of cooling systems used in the greenhouses in Greece today:

1. *fan and pad*
2. *fog*

Some of the advantages of these are:

- They can guarantee with accuracy the desired temperature and relative humidity.
- They can be used automatically.
- They help the plants during all the steps in their growth.
- They provide the possibility of a full exploiting of the greenhouse all year round.

- Their running costs are not high.

Some of the disadvantages of cooling systems are:

- They have a high initial cost of installation (on average 1.5 million Drs/ str- prices of 1990).
- They require a very good quality of water: water conductivity has to be less than 700 μmhos.
- In order to be totally efficient, the dimensions of the greenhouse must not exceed certain limits.

Theses limits are calculated theoretically (because of the need to create electric current of particular intensity or particular velocity in the increase of relative humidity). They are also recommended for practical reasons if one considers the Greek conditions These limits are :length 80±10m and width 40±5m. This means that the average size of the greenhouse will be between 3 and 4 stremmata[1]. If the size of the greenhouse is bigger, there is the creation of vertical air-streams or air-streams of an opposite direction of the one that the cooling is created. These air-streams are created because of various factors which can be constant or random. Some of these factors can be:

- The variation of the water supply along the whole surface which can occur for various reasons.
- The different influences of external conditions and winds.
- Different size of plants (production technique and plant variety).
- The opening and closing of the doors.

The planning of the cooling systems depends on the relative humidity of the area and on the prevailing winds.

7.2.1 Factors which need to be considered for choosing a system

The system which seems more appropriate for the Argolid is the fog system because it presents several advantages compared to the fan and pad system.

These advantages are:

- It is simpler.
- It can create uniform conditions.

[1] 10 stremmata= 1 hectare

- It is not necessary to create openings (windows) in the greenhouse.
- It has the possibility of being used for spraying against pests and diseases and for application of leaf fertilisers.
- It functions regardless of the current winds.
- It can function in any season.
- Its running costs are very small.
- If the fog system is used, the diameter of the drop is smaller than 30 μm and as a result of this it does not disturb the workers (the glasses do not become hazy).
- Mist systems can cause the spread of pests and diseases, bending of the plants and leaching of the nutrients from the soil.
- It is claimed that the construction of a greenhouse may be simpler if the appropriate cooling system is established.

Cooling is not necessary during the winter period and especially during days with sunshine. On the contrary, natural ventilation is necessary to decrease relative humidity or the temperature or for the enrichment of the air with CO_2.

During the winter, the side airing of the greenhouse cannot always function for a number of reasons. So natural ventilation (from the roof) is judged to be necessary and such a construction is not simple.

7.3 Shadowing

Shadowing can be achieved by using curtains with a metal coating. Depending on the type of the greenhouse, these curtains can be:

1. Flat curtains which are at the level of the roof stanchion, in greenhouses (*venlow type)* with of low roof. They are recommended when a fan and pan system is established because they help the drift of the current.
2. A *"cabin type*" curtain which is situated 20 cm from the roof and is used in greenhouses with tall roofs where there is a big gap between the roof stanchion and the roof. This creates problems for the plants because of the opening and shutting of the curtains.

This curtain has many advantages, the main ones of which are the following:

- Small internal blocking of solar energy during the hot winter months and easy extraction through the windows of the roof.
- Considerable saving of energy during the winter nights.
- Its running does not cause problems for the plants.
- It decreases the difference of temperature and relative humidity between night and day to the optimum levels (8°C). This is done at a minimum cost. This is a major problem for Greek greenhouses and is one of the main factors in weakening the plants and spreading diseases.

The functioning of the curtain should be made automatic by means of a photo-electric cell and thermostat. Taking into account the weather conditions of the Argolid a shadowing of at least 50% would be recommended.

7.4 Size of the greenhouse

In general the bigger and squarer a greenhouse the less the cost for its construction and running. However, for Greek conditions where there is a lot of sunshine even during the winter months, it is considered that the smaller the greenhouse is the better. This is because a smaller greenhouse can be aired more easily and its environmental conditions are optimised. The problem of airing greenhouses under Greek conditions exists throughout the whole year. It is much more serious than the problem of heating which is necessary for five months only: from November to March.

Considering the demands of roses which were mentioned previously the dimensions of the cooling and airing systems, and practical experience, a greenhouse with roses should be not bigger than 4 stremmata with optimum dimensions of: 40±5m of width and 80±10m of length (Bournakas, 1990).

The ratio between length and width of 2:1 gives the maximum thermal efficiency.

In practice, it has been shown that in larger greenhouses the cooling systems do not perform well and do not protect the plants, especially at high temperatures. The partition of larger units is not a solution because of the lack of contact of the two sides with the external environment and because of the absence of side airing.

7.4.1 The aspect of the greenhouse

The aspect of the greenhouse is a very important factor for the Greek conditions and it needs to be carefully thought about. An appropriate aspect alone does not contribute seriously in differentiating the climate of the greenhouse when there are mistakes in construction: i.e. insufficient ventilation, too large a greenhouse. The same applies in areas with limited sunshine (e.g. countries of Northern Europe).

When multi-span greenhouses are considered and those are the most popular in Greece, aspect involves two important factors: on one hand it deals with the direction of the length and on the other with the direction of the roof.

7.5 Type of the greenhouse

It is in general accepted that the roses cultivated under greenhouse conditions give the maximum yield when the greenhouse is made from glass. The reason for this is that this type of greenhouse is the only one in which all the necessary equipment can be installed and function effectively. In addition to this, the returns from a crop like roses allow glass to be used. If the choice is between glass of the *Mertele type* and common glass (the two major types used in Greece), it seems that there are not considerable differences in yield (Bournakas, 1990). The only difference is that under glass the red varieties of rose, which are the most profitable, produce flowers of higher quality. What would be recommended is common glass of 4-5 mm thickness.

The rose plant, because of its height in the greenhouse (especially during the hot months), and the high density of plants per stremma has increased requirements for ventilation and the circulation of air. For this reason the type of greenhouse which is established, is the one with a *high roof* which leaves a lot of spare space above the plants and allows the creation of small wind currents.

On the contrary, in the *venlow type* greenhouses no matter how big the vertical side is, the free space above the plants is not so large as in the greenhouses with high roofs. They also do not have a window in the roof and cannot have a *"cabin type"* curtain and neither do they usually have a side ventilation.

Four major factors need to be taken into account when the feasibility of a unit for growing roses is considered:

- the light sufficiency
- the water quality and availability
- the heating facilities and
- the labour skills and availability

Roses depend very much on light especially since their viability in modern units is based on the ability of the production to go on during the winter months without pruning or resting. The production of flowers by the rose plant is directly linked with the level of light which affects the number of buds, the number of blinds and the number of bullheads. The characteristics of light transmission in a greenhouse can affect the yield and consequently the profit of a unit.

Two factors need to be considered for proper winter light penetration:

- the proportion of glass or other semi-transparent materials and metal
- the quantity of internal equipment above the plants: thermal screens, irrigation, heating.

The need for maximum penetration of the light needs to be weighed up against the second major requirement of the roses which is the heating. The roses are grown during the winter, so the greenhouse must be heated, with fuel consumption being high. As a result, there is a conflict in chosing appropriate heat saving material (double glass, hard plastic, polythene) without sacrificing penetration of light and maintaining the maximum production.

7.6 The heating system

In order to grow roses during the winter months successfully the temperatures should be maintained between 16-18°C. Depending on the expected climatic conditions this means that an ability of having temperatures of 15-20°C is required. It is necessary that the heating system provides uniform temperatures and for this reason vertical or horizontal gradients should not exist. Whatever contributes to the passive increase of the temperature has to be considered: the aspect, the type of curtain, the method of irrigation (Efstathiadis, 1984).

The most commonly adopted heating method is the system with tubes carrying hot water at the soil level. These are situated under the cultivation and around the perimeter of the greenhouse and the method is recommended for the following reasons:

- It contributes to a better distribution of the hot water and therefore to a uniform heating.
- It provides heating both of the soil and of the air in the greenhouse.
- Since roses are a perennial crop, the system is established once.

A system with small holes based on hot water under pressure or steam is preferable to one with larger tubes because it can respond better to changing conditions. The tubes should not be established on the roof of the greenhouse above the plants because on one hand they reduce the amount of light reaching the plants and on the other they produce unwanted high temperature gradients.

Systems of air heating are also appropriate though the tubes may need protection from damage from the plants (i.e. thorns) and this tells against the main advantage of this system: its low cost of installation.

7.7 Replenishing with carbon dioxide

The large leaf surface of the roses and the high temperatures used for the cultivation make it ideal for replenishment with CO_2. The normal atmospheric content in CO_2 is 300 ppm and when roses are grown under conditions of high temperature and light, this level is not sufficient because it limits their growth.

The target should be a concentration of 1000 ppm during the day. The low winter temperatures require that the windows are closed and demand the use of CO_2 even for some hours during the day.

If the fuel used for heating is propane a combination of the installations for heating and CO_2 can be done and this contributes to a considerable cut in cost.

7.8 Drainage

Land reclamation by draining is necessary when growing roses because they are a perennial cultivation and there are is no way of leaching so that existing salts are taken away. Because the drainage system is essential for the efficient functioning of a greenhouse some commonly observed mistakes should be avoided. These are:

trenches which are not in a straight line, the bad position of the drainage tubes, poorly protected ends of the tubes which allow the entrance of animals e.g. rats, e.t.c.

7.9 Soil

An examination of the physical and chemical characteristics of the soil is useful before any improvements are made. The optimum soil for growing roses in a greenhouse is light (sandy-loam). However, when the roses are grown in natural conditions they can also do well in medium or heavy soils. The advantage of good soil is that it allows a good airing of the roots and decreases the consequences of bad irrigation. The optimum pH for growing roses is 6.5. A mechanical analysis of the soil, its organic content and its pH determine the amount and the kind of soil improvers that could be used: sand-pebble, muck or turf.

7.10 Irrigation

Water is a major factor which should be examined since bad quality of water is a negative factor for establishing a greenhouse. It needs to be of good quality, with a conductivity of less than 800μmhos and a degree of alkalosis of less than 10 (SAR) and as small a CL content as possible (< 50 ppm) because roses are sensitive to chloride.

7.11 Buying the plants

One of the most difficult problems is finding plants which are not affected by the wood pathogens (e.g. *Coniothyrium sp., Agrobacterium tumefaciens* etc). The reason for this is that during the pruning, the cuts which are created, facilitate the expansion of these pathogens. Another reason for the encouragement of contaminants is the use by many owners of nurseries in the same place for years, this allows the pathogens to settle (Nisen, 1972). Plants should also be imported from the same source or else there is the danger of importing many pathogens. The situation in Greece is such that very often a nursery where the plant comes from, is recognised by the pathogen appearing. The root-stocks which have better adapted to the Greek conditions are the following two: *indica* and *manetti.* Another stock which has also been used widely recently is the *inermis* one. This has the advantage of producing many seeds and favours the production of plants from seed and grafting. In this way one can avoid cuttings which help to spread pathogens.

The average number of plants per stremma is 6.500±500 though this varies with the variety. However, under Greek conditions, because of the higher amount of sunshine, the plants develop a lot of foliage and a satisfactory number of plants is 6.000 plants/stremma. An important factor which needs to be considered before choosing varieties is the size and the orientation of the unit: whether the unit targets the internal market or it will do exportations. Varieties chosen and the appropriate size for them changes according to these last two factors.

7.12 Conclusions

The rose is a plant which has high technical requirements for it to be productive and commercially competitive.

Highly technical equipment is required to produce the optimum yield under greenhouse conditions during the whole year and especially in winter when the prices are higher. Installation of systems like cooling, heating, carbon dioxide and careful planning for major light penetration are considered basic factors for the business to be competitive. Knowledge and capital are required for all this infrastructure. Good knowledge of the physiology of the plant and of the importance of light, temperature and humidity are also necessary.

An important point is the sensitivity of roses to salts especially to Chloride. Considering the concentrations of Chloride in the Argolid (see Chapter 5) roses could be grown only in the periphery of the Argolid valley where there is not a problem of high chloride concentration. In the main valley, even areas irrigated with water from the canal could not be strongly recommended .

Existing greenhouses with roses which are located both in the main valley and in the periphery do not seem to have problems with their quality and yield because of the quality of water. However if rose cultivation were to become more generalised, attention should have to be paid to this, since as was explained in Chapter 5, the water of Anavalos adds considerable amounts of salts in the long term.

The Argolid, climatically is an optimum area for growing roses in greenhouse. Lying in the SE of Greece it has high temperatures during winter and sunshine for most of the year even during the winter months.

Optimum size for installation of cooling systems (4-5 stremmata) may be appropriate from the physical and practical point of view but it is not economically viable as was discussed in the previous chapter. So, the case of greenhouse roses provides a classic example of a mismatch between what is considered as optimum from the biophysical point of view and backed up by policy and the other factors which influence crop choice.

The following chapter will examine roses from the socio-economic point of view and discuss whether the plant could be considered as an appropriate cropping option for the farmers of the Argolid.

Chapter 8

8. Examination of roses from a socio-economic point of view

8.1 Design of the case study and Method

This chapter and the previous one deal with applying the generic framework, which was tested for the Argolid, to a particular crop: the greenhouse roses. The product will be a final amended framework in the light of the findings of the case study of roses. Chapter 7 dealt with the specific biophysical and technical requirements of greenhouse roses. This chapter deals with the requirements of the plant from a socio-economic perspective and discusses the limitations of growing roses from this point of view. This is done through an analysis of interviews with the owners of greenhouses, discussion with a specialist from the Agricultural Bank of Nafplion and a review of Greek agricultural journals. (See also Section 1.2.3).

Greenhouse roses are selected as the focus of this case study. This particular crop was chosen in response to an offer made to the researcher to teach as an agronomist for a series of seminars organised by the Union Of Young Farmers (E.N.A), of the Argolid. These were financed by the Greek Ministry of Agriculture and were addressed to young unemployed farmers. Their purpose was to give them the opportunity to get training about the cultivation of a new "feasible" crop, in this case greenhouse roses. The duration of the seminars was three months. This included two months of theoretical courses (eight hours per day), one month of practice in a greenhouse with roses and visits to other greenhouses in the region and visit to the main flower market in Athens.

Of the twenty five people who were registered to attend the seminars, only fifteen were regularly present. Their age was between 20 and 25 years, with a few older participants. They were all unemployed and the majority were wives or children of farmers. Half of them had completed primary education only, one was an unemployed teacher of French and the wife of a farmer and another one had a lower degree in agriculture. The teaching focused on the biophysical requirements of roses and other major greenhouse plants e.g. carnations.

This work offered the opportunity to combine teaching with part of the field work for this thesis. This was done by recording the reactions of the students during the seminars and by trying to get a series of structured interviews, (questionnaires) with them. The next step in the fieldwork was a series of semi-structured interviews with the majority of the owners of greenhouses of the area and a representative from the Agricultural Bank. The reasons why semi-structured interviews were preferred instead of other forms of interviewing are explained in Section 1.2.2.

Teaching by the researcher commenced one month after the beginning of the seminars and followed lessons on the economic aspects of greenhouse production. The students were already disappointed having realised that it is almost impossible to own a greenhouse with flowers without having access to considerable personal capital. A description of how the financing of a greenhouse works through EU subsidies and loans from the Bank will be given in Sections 8.4 and 8.4.1 of this chapter. It is taken for granted however, that these people, who were young and unemployed did not have their own funds. Therefore they very quickly considered the seminars as inappropriate for helping them to improve their "bad" financial situation. It was obvious that the audience was not really interested in learning about the physical demands of roses as a plant or what their specific technical requirements are. As they admitted later during informal discussions, they were there for the daily allowance they were receiving. For the wives of the farmers, coming to the seminars was a chance to get outside of the house and socialise during the coffee breaks. Therefore the objectives of the students did not coincide with those of the organisers or instructors with obvious implications for the take up of the proposed crops.

During this period of lectures, a set of questionnaires was prepared to elicit information about the attitudes of the students to rose growing (Lemon and Park, 1993). Permission was sought from the organisers to distribute them to the students, however, this was denied possibly due to a general spirit of suspicion and secrecy which prevails in Greece around the spending of public money.

As a result, the major points of the questionnaires were discussed informally with the students during the coffee breaks, the practical training and visits in greenhouses.
The questions covered were the following:

- Did you find the seminars useful?
- How do you see your future as farmers?
- Do you consider the possibility of running a greenhouse with roses some day?
- Would roses be an appropriate crop for the Argolid in your opinion and at what scale could they be grown?
- What is your relationship with the local agronomists of the Service of Agriculture?
- What is your experience with the Agricultural Bank?
- What is your opinion about the local agronomists who sell pesticides?
- What would be the major constraints which would prevent you from working as owners of a greenhouse with roses?
- How do you see the future of agriculture in the Argolid considering the problem of water quality and availability?

These questions were meant to elicit information about the feasibility of growing roses in particular but also to provide comparable information about other aspects of farming which were explored during the second framework of the thesis.
The students underlined the good organisation of the seminars and the high quality of presentations. However, they all emphasised that there was no chance at all to apply their training in practice, by starting a business with greenhouse roses. They stressed that this plant should not be suggested to unemployed farmers, since it was obvious that they have no chance of adopting it from the economic point of view. The students with a farming background were interested in finding out if there are any realistic suggestions from the Service of Agriculture for growing other crops. There were no worries expressed about the high technical requirements of the crop or requests for specific technical and economic information. For them the major obstacle was the lack of capital and this made the option unattractive.
Regarding the local agronomists of the Service of Agriculture, the farmers expressed the same opinion about them as those interviewed for Archaeomedes and the owners

of greenhouses. They showed disappointment and a lack of trust towards them because as they underlined they are either pure bureaucrats or dealers who sell pesticides.

8.2 A critique of the seminars

As was discussed previously, the seminars were organised to inform unemployed young farmers about growing greenhouse roses, in particular and flowers in general. However, the fact is that to start a greenhouse requires a considerable amount of capital (as it is discussed in Section 8.8.8.1), that farmers aged 20-25 do not have. This is obviously contradictory to policies trying to reduce the average age of farmers. On the other hand, as the interviews showed and is discussed in Section 8.4, it is very difficult to get finance from the Bank in the form of a loan or from the Service of Agriculture, in the form of subsidies.

Therefore before considering whether the plant is appropriate from the point of view of its biophysical requirements, one can see that for the Argolid it is difficult to introduce roses from the economic point of view.

The lack of guidance about feasible alternative crops is obvious if one considers the recent directives from the Service of Agriculture. A question that should be asked is according to which criteria roses were selected as the subject of the seminars? The participants of the seminars saw it as the chance to earn some money and then return to their previous state of unemployment.

Though the organisation of the seminars, according to the participants was excellent and the instructors were professional it is questionable whether they can be characterised as successful. If by success is meant a well organised seminars from beginning to end, then they were successful. If however the purpose of this kind of seminars is more than this: educating, informing, providing skills to people who are unemployed to give them a chance to get qualifications for a job etc., it was not.

The participants were very quickly disappointed after they became aware of the cost of running such a business (see Sections 8.8.1.1 and 8.8.1.2) and how bad the financial situation of the owners of existing greenhouses in the area is (see Section 8.4). It was more of a discouragement from growing roses than an encouragement. As soon as they knew about the financial requirements of the crop, they were no longer interested in learning about the biology of the plant and its specific physical requirements.

Many seminars of this kind are organised covering different sectors in the Argolid just as in the rest of Greece. The need is to make them really useful and helpful towards managing unemployment and not just a temporary release for the people who take part in them. One way of doing this would be to suggest realistic topics, provide good quality information and appear to have the desire to combat unemployment in the farming community. Farming in Greece is definitely a sector which suffers from unemployment (either hidden or obvious), and also from underemployment, as was discussed in Chapter 6.

8.3 Interviews with the owners of greenhouses and Bank specialists

In the next stage of fieldwork, interviews were designed and undertaken with the owners of greenhouses in the Argolid, and with a specialist from the Bank. Nine out of the thirteen owners were finally interviewed in a semi-structured format which aimed to investigate the socio-economic feasibility of roses. The further interview with the agronomist of the Agricultural Bank of Nafplion, who is responsible for signing in the loans' department, was intended to find out the approach of the Bank to new agricultural ventures.

Considerable effort was necessary to undertake the interviews because it was not easy to contact the greenhouse owners. Due to the nature of their job they do not have standard hours during which they can be contacted and they would often be away selling their roses at the market in Athens, arranging for their export at the airport, or abroad attending a seminar. The persons who could be usually found around, were foreign workers (Romanians, Albanians or Bulgarians) who would hardly speak any Greek at all. The procedure through which contacts were made was the following:

The first farmer was contacted through the agronomist at the Agricultural Bank. Each farmer was then asked to introduce a further contact (the snowball process). Several phone-calls had to be made to arrange an appointment and there is a general spirit of suspicion if you try to find out about their financial situation, the labour they employ and the problems they face. It requires a lot of effort to explain to them that these interviews have nothing to do with the local tax office. This is the reason why it was not possible to tape-record the interviews as planned, instead they were recorded in note form, after their end. The first part of each interview required the interviewer to explain why this information was required and who would be the final recipient of the data.

The questions that each farmer was asked follow below. these were intended to obtain information regarding attributes from the generic framework and to consider issues which were judged as important and emerged from the second framework and the seminars teaching.

- How many stremmata[1] with greenhouse roses do you own?
- Where did you get funding for your greenhouse from?
- Did you face any problem with the Agricultural Bank[2] or with the Service of Agriculture?
- Where[3] did you get the information about the needs of the crop and the use of the technical equipment that is required?
- How do you get informed about new plant varieties or market changes?
- Do you attend seminars for further information locally, in Greece or abroad?
- How do you find markets abroad (if they export their roses)?
- What is your opinion about the local marketing of roses and what is the situation in the market of Athens in Amygdaleza?
- What do you think about the local agronomists of the Service of Agriculture; how helpful are they?.
- What do you consider the major problems in your job?
- How do you see the future of greenhouse flowers?
- Would you suggest this job to a young farmer looking for employment?

[1] 10 stremmata = I hectare.
[2] The Bank gives the loans while the Service of Agriculture in Nafplion is responsible for approving the participation and finance of a farmer in an EU project.
[3] Possible sources are: the local agronomists, private agronomists or foreign experts. This will be discussed later.

- What kind of labour do you employ: members of the family, Greek staff or foreigners?

The information from the interviews gave a very useful insight into the socio-economic feasibility of the crop. The biophysical and technical requirements of the crop were examined from the relevant literature. The sources of information about the suitability of roses as an alternative and sustainable option for the Argolid are shown in Figure 8.1.

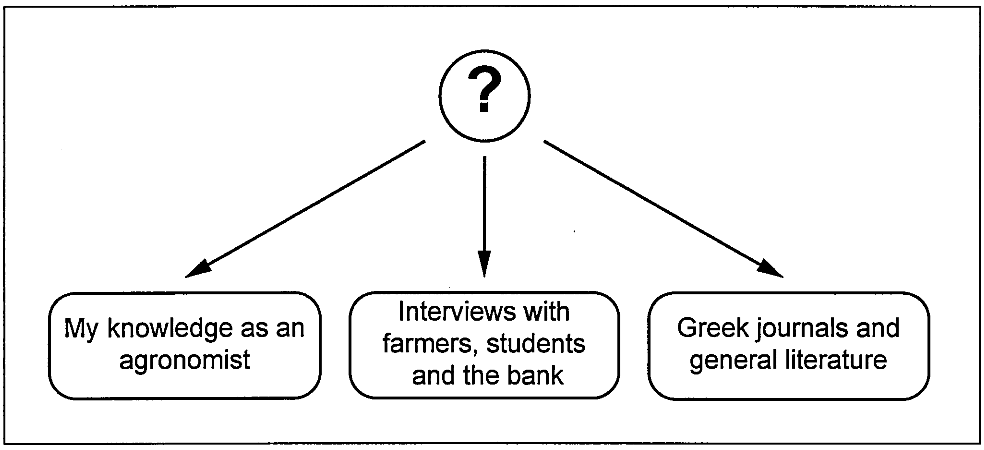

Figure 8.1: Sources of information about roses

8.4 Problems related to subsidies and loans[1]

The majority of the owners stressed that their relationship with the bank was a major problem with considerable difficulty in paying back their loans due to the high interest rates. Similarly, they mentioned that there is a considerable delay in the allocation of loans from the Bank and subsidies from the Service of Agriculture. They said that although the climate in the Argolid is ideal for growing roses, countries like Holland or France manage to produce higher amounts at lower prices because they have better infrastructure, lower fuel prices and much lower rates of interest: 7% for Holland compared to 26-30% for Greece.

Several cases of bankruptcies are recorded among the owners of greenhouses growing flowers. Also, there are cases of farmers who started a greenhouse with roses and then

[1] Considerable information regarding the schemes of finance of a greenhouse unit was derived from the Yeorgiki Technologia (1988, See references).

switched to a greenhouse with vegetables, considering the second as a more profitable option.

The inappropriate way in which the subsidies are allocated was cited as another negative point of the system. There is a problem of timing between the allocation of the loan from the Bank and the EU subsidies from the Service of Agriculture. They mentioned that the subsidies are delayed because of bureaucratic procedures and when they arrive in the farmers' hands, they usually do not use them for investing in infrastructure but for paying the large accumulated amount of interest on the loan from the Bank. When they sign for a loan with the Bank at a particular rate of interest this does not mean that the Bank will not change the terms whenever rates change. There are no fixed rates and all the rates of loans from the Bank are floating. Considering that the rates of Greek inflation are high and variable, one can imagine how this can affect the interest rates. One example of this is that in 1990 the interest rate was 17% and in 1995 22%. This means that someone who has taken a loan cannot be sure how much the total cost of the loan will be by the end of the loan period.

Also, some years ago, the subsidies were 20-30%, while now they have risen to 40% which makes a considerable difference to the farmer. The criteria adopted by the Service of Agriculture to assess the eligibility of farmers for subsidy, and those used by the Bank for giving a loan, were judged as unfair: very often people get a subsidy or get financed through the IMPs[1] not because they fulfil the eligibility criteria but because they have political acquaintances,(deputies, ministers or just because they are active registered members of the governing party) The lack of subsidy for the export of roses was mentioned as another economic constraint, in addition to which the

[1] IMP: Mediterranean Integrated Programs. Regulation (EU) No. 2088/85. (OJ L197, 27-7-85). The objective of the IMPs is "to provide an overall response to the diverse problems facing the regions and in particular to assist in employment creation and income generation. The countries concerned are the whole of Greece, most of the southern France and in Italy the whole of the Mezzogiorno and certain regions in the north. (Fennell, 1987).

farmers have to pay a contribution of 2% of their income to the OGA[1] though there is no danger of frost or hale for cultivations in greenhouses.

8.4.1 Terms and conditions for obtaining a loan from the Bank

It is taken for granted that the terms for obtaining a loan from the Bank are not the same for all the farmers. They are negotiable from farmer to farmer depending on the relationship of the farmer with the Bank (his history as a client) and on the political acquaintances of the farmer.

An average breakdown of finance for installing a greenhouse is 30% own contribution, 30% loan, and 40% subsidy, however there is a big variation in the amount of subsidy and loan. For example, one of the interviewed farmers for a greenhouse of 7 stremmata in 1985 received a subsidy of 25%, for 5 additional stremmata in 1988, he got 38%, and for two more stremmata in 1991, he got a subsidy of 60%. In the last case the subsidy came through the IMP and the previous two types were obtained through finance under Regulation 797/85.

8.5 Sources of farmers' information

Unlike the average farmer, most of the owners of greenhouses have a University degree, usually in Economics. They could be characterised more as businessmen than farmers since it is their business and marketing skills that they emphasise rather than their farming skills.

Most of them get information about the working of their greenhouse from foreign specialists usually from France or Holland. All the interviewed owners emphasised the lack of local agronomists who specialise in greenhouse plants. They also stressed that there is not a department in the Greek Ministry of Agriculture, responsible for advising on the marketing of flowers or their production and export.

The Greek Ministry of National Economy finances the installation of greenhouses, however, the people who are responsible for signing for the allocation of loans and

[1] OGA: Organisation of farmers' insurance. It usually compensates farmers against losses due to natural hazards e.g. frost or hail. These hazards however do not apply to crops grown in a greenhouse.

subsidies lack basic skills: they do not have the technical or scientific background to estimate what is required for the installation of a greenhouse unit and how fair or unfair a request is.

The local agronomists (of the Service of Agriculture) and the agronomists owning shops with pesticides are both considered to lack the required scientific knowledge. In the latter case they are considered as dealers with only an interest in making a profit. Another point which was underlined was the need to organise training seminars for local agronomists so that they could be in a position to advise the farmers who want to adopt these crops.

The owners who seem to be most satisfied are the ones who can afford to travel, usually abroad, to attend seminars in order to be informed about new varieties, markets, farming practices and infrastructure.

8.6 The market for roses

According to the farmers, the dealers are considered as one of the major enemies of the farmers who grow roses.

There are two large flower markets in Athens: the "big" central flower market and the one of Amygdaleza. It appears that there is not an appropriate system for the marketing of roses and it is perceived that the system as a whole works against the farmers. The dealers knowing that the roses cannot be preserved for long since they are perishable, do not buy until the farmers drop their prices to very low levels.

According to the interviews, one of the reasons for the unsatisfactory situation in the market is because there are many people involved in growing roses who have nothing to do with farming. They are businessmen who decided to get involved because of the availability of finance in the form of loans and subsidies. So, owing a greenhouse with roses was the excuse for taking the subsidy and investing it in other sectors. However, these people are the ones who sell roses at very low prices and this is against the interest of "full-time farmers" who earn their living from roses and cannot be competitive with the occasional farmers of this kind.

A similar argument has already been made about part-time citrus farmers in the central valley, to accept lower prices for their crops without jeopardising their livelihood.

Another marketing option is to export the flowers personally. However one critical factor for the economic feasibility of this is the need to own ten stremmata of roses at least. The majority of owners of greenhouses however, own, on average 4-5 stremmata. These people are condemned to fail from the beginning because they cannot produce the required amounts to satisfy the needs of the market whether it is external or internal throughout the whole year.

It may seem remarkable that none of the interviewed farmers mentioned anything about water quality as a problem or as a future concern. This is because the biophysical requirements are of secondary importance, compared to the socio-economic for the particular crop.

8.7 Small units with greenhouse roses and the problems that they face

Greek exporters face serious problems because the demand for roses in the international market is high and constant and the competition in the international markets is very fierce. There are many reasons why the situation is such. The most serious are, the small size of production units, the low total Greek production of roses, the varieties grown which are not appropriate for exports, the lack of experience of growing and exporting roses and the bureaucratic procedures affecting the exports. Also, the way the Central flower Market, in Amygdaleza- Athens, functions, affects the quality of the exports as will be shown below.

Greece is self-sufficient in roses throughout the year except for the two peak periods of Christmas and Valentines' day. But even during the peak period there is not a real problem of availability since other flowers are imported. This means that each established unit needs to be oriented towards exports to be able to survive, since it is through exports that farmers get higher prices.

However, to be competitive in the international market, the size of the unit must increase considerably. In Greece, new units with a total of 250 stremmata were established during the period 1983-1993. These had an average size of five stremmata. Such units with a construction cost of 12 million Drs, and rose prices at 27-35 Drs/ rose are uneconomic. At the same time they cannot satisfy the demands of the dealers throughout the year, and especially during the peak periods, because of their size.

There are other greenhouse units which were constructed several years ago at a lower cost (plastic greenhouses) and which can be profitable today. The problem is not with the latter, but with the former which were constructed during the last three years (average size: 5-7 stremmata) and the ones which are going to be constructed in the future. The next section deals with the problems arising from owning small units of five stremmata. As was previously mentioned, this is the average for which a farmer gets a subsidy and corresponds to the average amount of money that the farmer can afford to contribute from his own capital.

8.7.1 Why it is not profitable to grow roses in units of five stremmata?

8.7.1.1 Financing of the investment

In general, no farmer has enough capital to allow him to make an investment of 50.000.000 Drs[1] for 5 stremmata of greenhouse. Usually the investment is made under EU directive 1262/82 which was replaced by the 797/85 where the personal contribution is 30%, the subsidy 30% and the remaining 40% is covered with a loan from the Agricultural Bank, at an average interest of 20 %.

Under these finance conditions an investment of 50 million Drs which can reach 60 million Drs with changes in interest rates means that the farmer may have to pay back 6.5 million Drs back per year. There is a period of two years "grace" but this period typically expires during the construction of the greenhouse due to various delays.

[1] 400 Drs = £1 = 1.3 ECU. Or 1 ECU = 307 Drs.

8.7.1.2 Cost of production[1]

The cost of heating a greenhouse is on average 400.000-450.000/str/year and is therefore of the order of 2.250.000 Drs for a unit of five stremmata.

The annual expenditure for pesticides is around 150.000 Drs/str or 750.000 Drs /year for five stremmata.

The cost of labour is around 4.200.000 Drs/ year assuming that four[2] persons are employed with a wage of 3.000 Drs per day.

The cost of electricity is around 500.000 Drs per year.

The cost of transport varies considerably depending on the distance of the greenhouse from the final market, it is 500.000 Drs on average per year as estimated by the farmers when roses are transported by road to Athens.

The cost of various other general expenses is estimated in around 500.000 Drs.

The above mentioned costs add up to 8.700.000 Drs per year including the cost of the plants.

Usually a unit with 30,000 plants, at a cost of 350 Drs /plant and thus a total cost of 10.500.000 Drs is paid back in 6-7 years. From such a unit one cuts on average 60.000 roses per year per stremma or 350.000 roses per five stremmata.

Taking into account the highly varying annual inflation, the annual repayment is around 2.100.000 Drs per year.

So the total cost of a unit of five stremmata producing flowers for the internal market and including the repayment costs for the plants reaches 10.800.000 Drs per year.

8.7.1.3 Income

Such a unit produces 350.000 roses per year which are sold at 36 Drs per rose. The income is thus 12.600.000 Drs per year. It has to be noted that a unit which is exporting its produce may be reduced to 300.000 roses because of the required quality selection. However the expenses and the annual income because of higher prices in the international markets, are also going to be higher.

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[1] The prices and costs estimated for this and the following sections are prices of 1993 and day wages are estimated for foreign and not local labour.

[2] Four is the average number of employees a greenhouse unit of five stremmata works with.

For the internal market and with a price of 36 Drs/rose, in the international market the prices are around 60 Drs/rose, the profit is going to be different.

From the above data, the net profit of the unit is only 1.450.000 Drs (income minas expenses) while the repayment is of 6.500.000 Drs per year. It is obvious that a small unit of five stremmata cannot be competitive and is uneconomic.

It also appears that an unrealistic estimate is often made about the potential production and income from a greenhouse when planning its introduction. This is often perceived to be due to the poor guidelines produced and communicated by the Service of Agriculture.

8.7.1.4 The small units and the international market

These small units cannot survive independently in the international market neither can promote their production. Several reasons can be stated to explain this.

A greenhouse of five stremmata can produce up to 2.500 to 3.000 roses per day on average. This means that the foreign dealer with whom the farmer has to cooperate, will have to find clients able to absorb this production. However, there is a high fluctuation of production during the year and the distinct production periods are described below: For the period of 15th November to 28th February, when the demand in the foreign market is high, the dealer needs large amounts to satisfy the demand of his clients. In this period, the greenhouse may produce 800-1000 roses per day which is not enough to satisfy the needs of the dealer. The cost of transport needs to be taken into account, particularly during this period when production is low and the cost is proportionally high.

The next period is from March 1st where there is overproduction, reaching a peak in April and May. Thus there is a significant problem of absorbing all the roses. The farmer will face a serious problem in selling all this amount because the dealer will be reluctant to buy it. The reason for this is because the farmer did not satisfy his needs during the previous peak period. Foreign dealers prefer to collaborate with large units who are able to fulfil the dealers' requirements during the peak periods. In their turn, these farmers can expect the dealer to absorb the excess of their production for the rest of the year.

This problem could be solved for the small farmers if they collaborate in exporting. This already happens in some areas in Greece, (but not in the Argolid), through the creation of co-operatives. However, there are other problems in this case, especially in the achievement of standard quality which the co-operatives cannot guarantee. Also, the running costs of these co-operatives need to be taken into account since they affect the cost of roses.

8.8 The flower market

As has been seen for the exports of roses to be economically viable there is a need for large production units. Currently, there are very few such units in Greece and none in the Argolid. The actual system of financing such units discourages potential investors. Another possible option for the stimulation of exports from the small units would be a change in the way the flower market functions. The flower market of Amygdaleza in Athens functions as a "bargaining" market where according to the interviewed farmers, the dealers are suffocating the farmer by having control of the prices and dropping them to very low levels.

The flower market could work instead, as was stressed by three of the interviewed farmers "like the system in Holland" where good quality would be paid for. Good prices would motivate the farmers to improve their quality standards. This would have a direct positive effect on the quality of roses for export and it would contribute to a better income for the farmer.

It is a common phenomenon, that, say out of 30.000 roses, one can find in the market, only 2.500 would be suitable for export. If the way that the market functions stays the same it will continue to be in the hands of the dealers and the prospect of improving the quality of export will be poor.

At the moment, the dealer receives the orders from the flower shops of Athens and the rest of the country and goes to the Flower market, where he buys flowers at very low prices. He can do so, because he has a high bargaining ability due to the considerable amounts that he buys. Then he sells these roses to the owners of flowershops at much lower prices than the ones they could obtain for themselves.

However, if a marketing system like the "Dutch clock", which is described below, were applied, a standard official price would exist for each type of flower, the owner of the flowershop would be aware of this price and would accept paying an extra 30% as a fair profit for the dealer. A higher price is always a good incentive for the farmer to try to improve his quality standards. Potentially, applying the Dutch model in Greece would improve the marketing of flowers considerably.

8.8.1 The Dutch clock

The flower market in Holland is widely considered as a model for the selling of flowers. It works as a form of auction, which guarantees a standard quality for the buyers and good prices for the farmers. To be more accurate, in each market there are halls, with one or two clocks in each of them. There are seats for the clients placed in the form of an amphitheatre, facing the clocks. The cut flowers or the pots, after they have passed a control test and are divided into categories, are placed in special wagons and are automatically carried into the auction rooms through a computerised system. The wagons pass in front of the potential buyers and an assistant, who sits under the clock and in front of a computer. Thus, automatically he has all the information concerning the products: i.e. the number of flowers per bouquet, the number of boxes and the minimum amount one can buy. This person transfers all this data to the buyers who can listen to this information via speakers attached to each seat.

The clock has 100 subdivisions and an arm which moves from 100 towards 0. In the upper part of the clock there is an indication of whether the figures are in gilders or cents.

After the assistant announces the information, the arm of the clock starts moving towards the smaller prices. The buyer presses a button to stop the arm, as soon as it arrives at a price at which he is willing to buy. Immediately after this, the identity of the buyer is marked on the clock (each buyer has a particular number and seat). The buyer, using his microphone informs the assistant if he wants the whole amount or not. The amount left is written on the clock and the procedure is repeated until the whole amount is sold. If nobody wants to buy and the arm of the clock arrives at the lowest agreed price, for the particular product, it is taken away from the room and destroyed. The grower receives compensation.

That is to say that all the products which are not sold, even if they are potted flowers, do not reappear to be sold at very low prices. Instead they are destroyed. The percentage of destroyed items is very small (2-4% per year). This happens because the products are usually of excellent quality, and the farmers know when the demand is high and they adjust the amounts of products that they send to the market accordingly. The information about each transaction is recorded at the central computer and all data stored for statistical reasons. At the same time, a printer connected to the clock prints the list with the amount that each buyer buys from each wagon. So the market personnel can place the purchased products in different wagons for each buyer, and these are automatically transferred to a special place that he rents. There, his own staff pack and load them. Thus, from the time of purchase to the time that the buyer has the products in his hands there is an interval of only 15 minutes. So, flowers which are bought in the morning, by that evening or next morning at the latest, are already found in the flowershops of Europe and America. This procedure guarantees very quick transport of the products, at the best conditions and with very high quality standards.

8.9 Further limitations and perspectives for the cultivation of roses

The small size of units and the way that the market functions, are not the only limiting factors for the export of roses from the Argolid and the rest of Greece. Some other constraints are:

- Most of the producers of roses, with units of 2-7 stremmata, have a strictly farming background. They do not speak foreign languages, they do not have experience of the bureaucratic procedures involved in the export process. So they cannot have direct, personal contacts with the foreign dealers. This kind of contact is fundamental for the growth of exports.
- The experience of growing roses is lacking in the farmers and the Greek "specialists". In addition to this, not all the varieties grown are exportable. This, does not mean that the cultivated varieties are not of good quality, they simply do

not fulfil the requirements of the international market. On the other hand the rose plants are very expensive so that the producers cannot afford to plant new varieties which are appropriate for export. Instead they may go on growing the old varieties for which there is no demand in the international market.

- Another problem is the inefficient quality control which often does not comply with international standards. As a result of this, farmers who export risk losing their credibility with their foreign clients.

The process of exporting roses may be very time consuming for the exporter. The customs houses for example are closed at weekend. Also, Olympic Airways, (the national airline) charges a very high transport cost, despite the efforts of the Ministry of Agriculture to reduce it.

The whole process of transporting cut flowers from the greenhouse to the point of the final loading at the local Customs House can prove a real odyssey. Another problem is that the Agricultural Bank of Greece, with which the farmers usually collaborate, does not have in its regional departments, sections for import-export. As a result the farmer must look to other banks, with whom he has no experience, to obtain and fill in the export documents.

The cut rose, and the cut flower in general, needs to be transported quickly without losing precious time over bureaucratic procedures. To speed up the process, the relevant legislation should be made more flexible and less bureaucratic.

Many of these problems are a consequence of poor infrastructure and the lack of modern business thinking. They also occur because of inadequate technical and economic support from the state for those farmers who would like to escape from the traditional ways of growing and marketing their products.

The quality of Greek roses is improving gradually. Also, the quality of the roses of the Argolid is excellent due to the specific climatic conditions of the area compared to Northern Europe (See Chapter 5).

With improved conditions, Greece could become a significant producer of roses and earn an influential place in the markets of Europe and the United States. Help from the state in simplifying the bureaucratic procedures and from the Agricultural Bank of

Greece by making loans more accessible to farmers would contribute considerably towards increasing exports.

The decision-making of the farmers regarding the adoption of roses will now be represented in the form of decision trees. They were created with the same logic as the ones in Chapter 6. (See Section 6.1).

8.10 Decision tree for the adoption of roses in the Main Valley

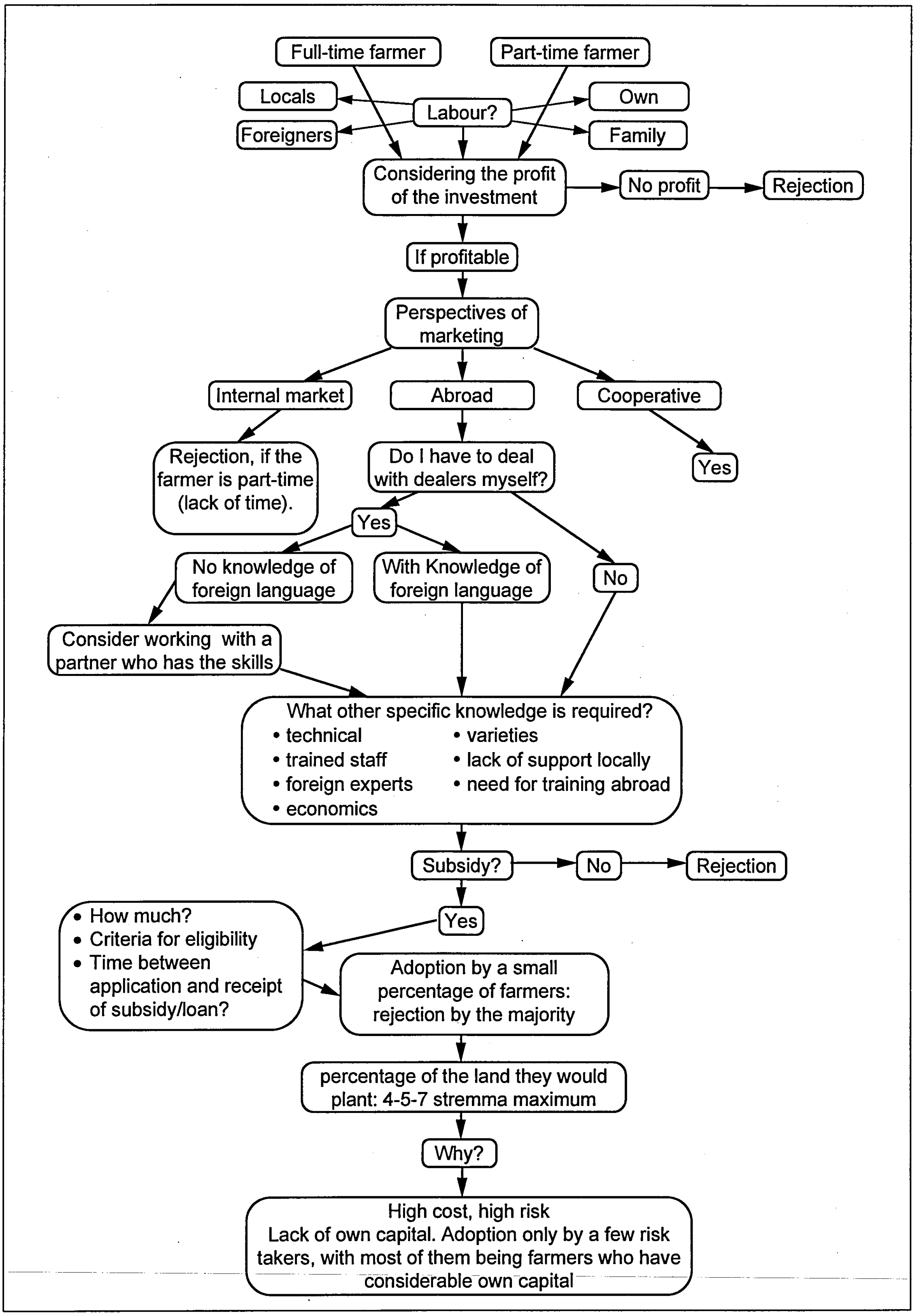

Figure 8.2: Farmer in the Main Valley considering adoption of roses

8.11 Decision tree for the adoption of roses in the periphery

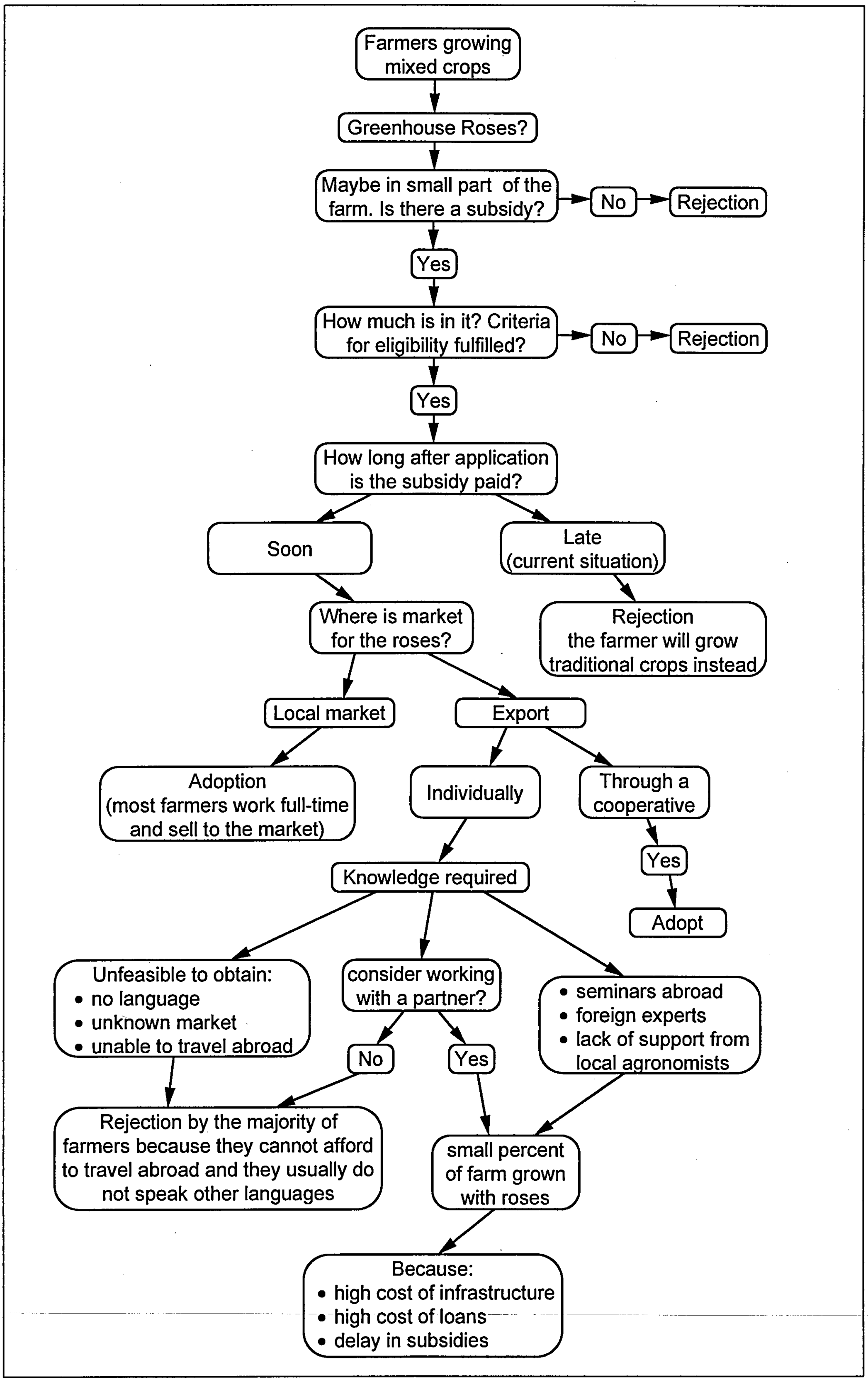

Figure 8.3: Farmer in the Periphery considering adoption of roses

Decision-trees were produced from the analysis of the interviews with the farmers and key actors of the Argolid. They represent both the goals of the decision maker, in this case the farmer who is asked to grow roses, and the constraints on choice that are present in the Argolid agroecosystem (Conway, 1985).

The two major divisions of farmers which were identified from the application of the generic framework to the Argolid are also valid here (see Chapter 5). There were two major decision trees produced, one for the farmers of the main valley and one for the farmers of the periphery. The farmers of the main valley and the periphery do not respond in the same way when faced with the same crop choice. The initial differentiation of the farmers is between those who farm full- time and part-time.

The farmer of the main valley seems to be initially concerned about the amount of labour required to grow the plant. The reason for this is, as was explained in Chapter 5, that the majority of the farmers of the main valley are part-time farmers. The amount of time they devote to farming is significantly less than that of the farmers of the periphery. Whether they have a full-time job outside farming, or they are full-time farmers growing oranges only, they spend only a small amount of their time working the land.

This shows that profitability is not the only motive of a farmer in choosing a crop. The farmer of the main valley will not pick a crop which requires high labour commitment even if it is the most profitable option presented to him. On the one hand, as mentioned, he does not have the time, and on the other, he does not want to farm full-time however profitable, because of the low status that he attributes to farming.

In contradiction, the farmers in the periphery, being mainly full-time farmers and using their own and their family's labour will not give the same emphasis to the amount of labour required. The farmer in the periphery has his own and family unpaid contribution, while the farmer in the main valley usually uses paid labour. As far as marketing is concerned, the farmer in the periphery, would not consider it a problem if he had to go to the market to sell his roses since he already goes to sell other products and he knows the market as an institution.

Thus, the farmer of the main valley, who is mainly a monocropper, is used to selling his crops through the co-operative and having to go to market would not be feasible for him considering the time involved.

The farmer in the periphery appears more open to adopting a new crop for part of his land, so that he can increase his income which comes from polyculture anyway. The co-operative is a preferred way for marketing the roses for both the farmer of the main valley and the periphery but for completely different reasons. For the farmer in the periphery it is the only way to sell his products abroad since he usually lacks the skills or required knowledge, but the farmer of the main valley would go for the co-operative because he does not have the time to market his products himself in the internal market.

Farmers in the main valley, having a higher education than those in the periphery, might be expected to ask questions about the specific requirements of a crop before asking about the existence of a subsidy. Greenhouse roses, unlike many of the crops which are known to the farmers of the area, have very specific biophysical, technical and economic requirements which demand particular knowledge and skills.

If the incentive for growing the plant is the high profit to be earned from exports, this may prove to be a problem for the majority of the farmers and definitely for those of the periphery. Roses are currently marketed through direct contact with the dealer and not many farmers have the appropriate linguistic skills. Similarly, good accounts are required and this can be a restrictive factor for most farmers. In the Argolid very few farmers keep accounts.[1]

In addition to this, it is not coincidental that all the farmers who grow greenhouse roses in the Argolid have finished high-school education and a good part of them have a university degree in economics. This is a striking difference compared with the average education level of farmers.

After the farmers have considered labour, marketing and technical requirements, the possibility of a subsidy is examined.

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[1] Only farmers who receive aid for farm improvement plans keep farm accounts. EU Reg. 797/85, (Art. 9).

The existence of a subsidy is a crucial factor in the adoption of a crop. One of the conclusions from the second framework was that subsidies have played a critical role in the adoption and expansion of oranges and they have also contributed to the uprooting of other crops.

Regarding roses, the existence of a subsidy is also catalytic for their adoption, bearing in mind that the plant requires a large investment in infrastructure. However, even if a subsidy exists there are many farmers who would be discouraged from growing roses because of their knowledge of the delays in the arrival of subsidies and their bad timing with respect to the capital loans from the Bank. There are not many farmers who would personally have enough capital to start a greenhouse and there are even less who could manage to survive until the money from the loan and subsidy arrive.

The majority of "farmers" who grow roses in the Argolid do not have a farming background. They are businessmen or University graduates who saw the existence of subsidies as a good incentive to start a profitable business. The students who attended the seminars series, coming from farming backgrounds and being unemployed, immediately rejected the possibility of growing roses even if the plant is supposed to give a very good income in theory. Farmers who have greenhouses and who despite their high level of education and their own capital, have huge debts at the bank and no longer consider roses to be a good option.

Finally, very few farmers could adopt roses; those who can will be educated, with a considerable amount of capital and a good knowledge of economics. They must also be large risk takers. So, the level of adoption is expected to continue to be very small. Very few farmers will devote a small part of their farm to a greenhouse with roses. It is completely out of the question that a farmer with ten, twenty, thirty or more stremmata would fully adopt roses replacing his current crops. Farmers are usually risk averse as it was discussed in Chapter 4 and thus will go for safe crops rather than those which might maximise their profits.

The final chapter of the thesis will discuss the findings, conclusions and recommendations of the thesis.

Chapter 9

Findings, conclusions and implications

9.1 Introduction and summary

This research deals with the creation of a crop choice framework for a more sustainable agriculture. The aim of this work was to link natural scientific and socio-economic theory to finally produce a conceptual framework which is useful for policy formulation and decision-making.

This thesis started with two points in mind. Firstly, such a framework should give priority to how farmers create their agendas and how the latter can be elicited and secondly, it should be accessible and useful for the policy maker. For purposes of a better study the framework was divided into biophysical, techno-economic and socio-political subsystems. Work dealing with crop choice tends to emphasise the biophysical component. However, this work deals with all three parts but gives additional weight to the techno-economic and socio-political levels.

9.2 Discussion and conclusions regarding the research process

In order to determine what a framework for crop choice leading to a more sustainable agriculture should include, this thesis adopted the following approach. At first the debate about sustainability was reviewed to assess what the many definitions have in common in order to consider under what conditions agriculture could be characterised as sustainable and how it could become more sustainable. It was found, that no matter how the concept is defined, three common themes occur. These are plant and animal productivity, environmental quality and ecological soundness, socio-economic viability and political acceptability.

Also, a very important factor regarding sustainability is that it is site specific and one cannot say what is sustainable without having a particular area in mind. It is also a relative and not an absolute concept.

The research project was carried out in three phases:

In the first phase a literature review and personal agronomic experience were combined to establish a generic framework which brought together biophysical, socio-political and techno-economic attributes.

This framework was then applied and modified, through a case study of the Argolid valley in Greece. The agriculture of the area was examined extensively and two major factors were found to limit its sustainability. One was the water situation in the area and the other was the general political situation in Greece which affects local decision-making, research and policy. Finally, the modified framework was applied to a particular crop, greenhouse roses and it was demonstrated that it is not a sustainable option for the area at the moment. The following sections will present the findings of the thesis as they appear in each of the three frameworks of the thesis.

9.3 Generic framework (I)

The generic framework in Chapters 3 and 4, explored which attributes a crop choice framework should include. They are represented below in Table 9.1.

Biophysical attributes	Social attributes
1. Type of crop production system 2. Climate 3. Soil 4. Slope 5. Irrigation water quality and availability	1. Land ownership-land inheritance 2. Size of holdings-land fragmentation 3. Education of farmers 4. Motivation of farmers a Full-time and part-time farmers b Status attributed to farming c Perception of risk or uncertainty 5. d Adoption of innovations 6. Information and farmers
Techno-economic attributes	**Political attributes**
1. Sources and availability of capital 2. Existing markets: internal, external, viability of markets 3. Transport and distance from the market 4. Labour intensive or capital intensive agriculture 5. Price support, subsidies, quotas 6. Existing technologies: irrigation, fertilisers, pesticides, new varieties of crops 7. Dependence of the system under consideration on external technologies - ability to survive on its own	1. The political administration affecting agriculture and farmers 2. Types of policy affecting agriculture (from an hierarchical perspective): regional, national, EU 3. Subsidies, price support and quotas

Table 9.1 Attributes of the generic framework

9.4 Argolid- the biophysical and socio-economic subsystems (Framework II)

Chapters 5 and 6 deal with the application of the generic framework for the Argolid Valley in Greece. The integration of scientific and socio-economic data contributes to the creation of the decision-trees which are represented in section 6.5. Two factors seem to critically affect the sustainability of agriculture and crop choice from the biophysical point of view for the Argolid. These are the distribution of rainfall and water quality and availability.

Rainfall is concentrated over a period of five months while the remaining seven months of the year are almost completely dry. Water is a key factor for the sustainability of the area over both the short and the long term. The depletion of water stocks and the subsequent intrusion of sea water has threatened agriculture in the short term and the addition of salts from Anavalos poses a long term threat.

Other factors which appear to affect crop choice are various policies, technologies and a dramatic change in agriculture from a Mediterranean style polyculture to a citrus based monoculture after 1960.

From the examination of the socio-economic and political system key factors which affect sustainable crop choice are: the political culture in Greece, the small size and fragmentation of farms, the lack of credit and the existing typology of farmers from which the status attributed to farming emerged as a key factor.

9.5 Greenhouse roses (Framework III)

Chapters 7 and 8 considered the biophysical and socio-economic requirements of greenhouse roses. As with Framework II, the integration of data is represented through decision trees in Chapter 7. It was found that the socio-economic components related to rose growing were more influential over decisions to adopt the crop than were its biophysical characteristics.

The cultivation of greenhouse roses requires:

1. Considerable personal capital which is available to few farmers.
2. Specific skills: knowledge of foreign languages for marketing abroad and for the acquisition of information about the cultivation of the plant from overseas experts.
3. Knowledge of economics to deal with the complicated accounts of the business.

A number of related factors were found to determine the way roses are currently grown.

1. Small units of four to five stemmata (average size in the Argolid) are not profitable.
2. There is a poor co-ordination between the Service of Agriculture (subsidies) and the Agricultural Bank (capital loans).

3. The cultivation is only practical for a minority of farmers who:

a. have personal capital

b. have University or advanced level education, preferably in Economics and knowledge of a foreign language (English or French).

Therefore roses would not appear to be a sustainable option for more than a minority of farmers in the area. The final part of this chapter will discuss the implications arising out of the main findings of the thesis.

9.6 Policies which do not take into account the individuality of the Argolid

It was concluded that the policies, both national and EU, on one hand plan in the short to medium term and on the other they do not really considered the particularities of the area. The latter often happens as a consequence of planning at the macro-level, (the European Community or Greece in general) without consideration of how this translates at the local level (Lemon et.al., 1995). A framework should support this translation by establishing realistic local zones based upon attributes that are appropriate to the area. For example, from the point of natural resources alone, the Argolid valley should be divided into at least two zones. This would mean that orange trees should not be planted so extensively in the periphery, due to the lack of water in this area. A review of the most recent directives communicated by the Service of Agriculture in Nafplion indicates that farmers in the Argolid have few realistic cropping options. Realistic from this point of view refers to biophysical as well as socio-economic factors. On one hand the degradation problem is acknowledged, but on the other crops which contribute to further depletion of already degraded water resources, are promoted. At the moment, the crops which are promoted through price support and therefore have a good chance of being taken up by the farmers, are various varieties of citrus, e.g. Salustiana oranges or Navel oranges. In addition as was mentioned in Chapter 6, rainfed, traditionally grown crops in the area, like tobacco or vines are considered as uneconomic by the European Community standards and subsidy is given so that the farmers cease to grow them.

Farmers are often asked to consider crops with inadequate information about their marketing and cultivation. In consequence, the farmers go on planting orange trees, without worrying about the long term implications of their practices.
One cannot expect the farmer to have serious environmental concerns for future generations when he cannot even make a living himself. He will simply go on mining the land to survive, as is the case with the farmers in the Argolid.

9.7 The Argolid as a Mediterranean region

It is important to consider that the Argolid and Greece are part of the Mediterranean. Thus one will realise that trying to convert the agriculture there to a Northern-European style agribusiness is unrealistic and pointless (Ruiz, 1982).
The reason for this is because the Mediterranean has a different landscape, climate and culture as was stressed in Chapter 5. The variety of landscape is part of the individual characteristics of the area and should be maintained instead of trying to change it by imposing an agribusiness model. What was found is that the pre-sixties agriculture in the Argolid operated within the Mediterranean model: polyculture, co-cultivations, closed energy cycles, rain-fed rather than irrigated, particular crops for particular areas, e.g. vines and tobacco on the hills vegetables and irrigated crops in the valley near the existing sources of water. This agriculture has been maintained for long time. Disturbance of the system appeared because of uncontrollable and excessive pumping to cover the needs of the water demanding and heavily promoted citrus crops. This led to sea intrusion into the aquifers and resulted in heavy salinity of the water making it unacceptable for irrigation . The Argolid is a typical example of how technology can contribute to the destruction of an agricultural system when not handled properly and used wisely.

9.8 Water as a common good and as a factor affecting the sustainability of the area

One essential element missing from the policy scene in the Argolid is the consideration of water as a common good and not just private property for personal use. Farmers seem not to account for the fact that they are using a common good and by depleting it they deprive themselves, other farmers and future generations of access to the resource. Similarly, farmers will tend to drill additional boreholes if the only restriction imposed on them is that it should be a distance of fifty metres from a neighbouring one.

Because water is an essential factor which restricts the sustainability of the area, it was concluded that if crops are to be suggested they must be salt tolerant and not especially water dependent.

For example, drip irrigation might be a better option than the sprinklers which expanded rapidly after 1981 (Reg. 797/85). Drip irrigation contributes to a more even distribution of water and contrary to the sprinkler system does not affect the foliage with salts. For the periphery which suffers from water depletion this would be a good option. For the main valley however, one needs to consider the effect of the salinated water in the irrigation system. Currently, the farmers in the main valley prefer to irrigate with the flood system when using the water from the canal and use their sprinkler system only for protection against frost using the water from their salinated boreholes.

Considering that the sprinkler system is still relatively new, it is unrealistic to expect farmers to replace it with drip irrigation. However it could be applied to new farms instead. Also, in terms of equity, there are not the same opportunities for the farmers of the periphery and the valley. The farmers in the central valley have access to the water of Anavalos while the farmers in the periphery do not.

In questions of availability and access to water, three village types can be identified (Allen et. al, 1994). These are the villages at the Western end of the valley which have both good quality water from relatively shallow wells (80 metres maximum) and from Anavalos, and thus the opportunity to pump from their own wells which is cheaper for them. There are the farmers in the central valley whose wells have been salinated and they irrigate from Anavalos, using the water from their salinated boreholes for anti-frost protection. Finally, there are the farmers in the periphery who need to pump from deeper and deeper wells, who do not have access to the canal and for whom there is no plan in the near future (Allen et. al, 1994). Despite this fact, it was concluded from the interviews that they will go on growing oranges until the last drop of water has been pumped. Finally, in terms of agroecosystem stability water has been, and is likely to continue to be, a strong destabilising factor in the Argolid.

9.9 Crops requiring specific skills

An important element that a framework for crop choice should include is whether a crop requires specific skills from the farmer, e.g. knowledge of languages, economics and the need to deal with complex infrastructure as was the case with roses. There is a need to know whether the majority of the farmers have this knowledge, could obtain it in the near future, or could be assisted in overcoming the obstacles posed by their lack of knowledge. This leads to the need to move towards education for knowledge based farming. As was shown in the case of greenhouse roses the need for particular skills can restrict the adoption of a crop . It has been argued that equity is central to sustainability, therefore when crop choice is considered it should account primarily for the needs of the majority and the maintenance of a diversity farmers and not only for a limited and privileged minority with innovative tendencies.

9.10 Credit and farmers

Lack of credit constitutes a problem for the farmers of the Argolid. On one hand, credit is difficult and expensive to obtain and on the other there is an absence of co-ordination between the Bank and the Ministry of Agriculture when subsidies are concerned. Also, due to the unstable financial situation in Greece, the farmers have suffered an overall loss of income during the last ten years. Similarly, subsidies have been reduced as part of the Common Agricultural Policy, reducing the ability of farmers to undertake innovative changes.

9.11 A typology of the farmers in the Argolid

The examination of the socio-economic system in the Argolid helped to identify the various types of farmers in the area. It made it clear that the farming population for varying reasons is not homogenous, therefore a uniform response should not be expected for suggested crops. A number of distinguishing factors have been identified which affect the decisions and behaviour of farmers.

1. Farmers of the periphery and of the main valley. The farmers of the periphery, as was discussed in Chapter 6, form a new farming society created from shepherds who came to the hills from the surrounding mountainous areas.
2. Full-time and part-time farmers.
3. Farmers attributing high status to farming and ones attributing low status.
4. Farmers farming using foreign labour and those using mainly farming with personal or family labour.
5. The majority of heads of farm households are over fifty. Also, the periphery has a higher percentage of young farmers who remain on the farm and do not seek employment outside agriculture.
6. The level of education in general has increased since the war, however farm children in the main valley tend to obtain a University education and those from the periphery enter farming direct from secondary school.

9.11.1 Status attributed to farming

An important finding of this thesis was how the status attributed to farming can influence crop choice. There is a need to consider the individuality of the farming society when a crop is being introduced. It was found that in particular the farmers of the main valley in the Argolid attribute a low status to farming and prefer instead the status from a low paid job in a public service. These farmers would not adopt a crop which requires a full-time commitment even if its cultivation would be promising financially.

Therefore status attributed to farming, as part of the examination of the goals, values and aspirations of farmers should be examined when change through introduction of crops is mooted. The assumption that farmers will grow any highly profitable crop suggested to them is unrealistic and can contribute to the failure of a project.

9.11.2 Aversion to risk

A further reason why projects can fail is that farmers tend to be risk averse. Therefore they may not adopt an option just because it is supposed to have a high profitability. Similarly, when they seriously consider adoption, this does not mean that they are going to adopt in full. So, aversion to risk is a very important factor to consider if crops completely unfamiliar to the area are to be suggested. The information the farmers will need about the crop and the time-lag between its initial introduction and subsequent adoption should be not ignored. After a thorough examination of how the farmers in the Argolid make their decisions one can say that they are risk averse and they would go for the safer instead of the more risky option irrespective of the profit attached to it.

9.12 The role of promoting micro-political interests

The way that political matters are handled in Greece also acts as a limiting factor upon the sustainability of the area. As was discussed in detail in Chapter 6 politics is found behind everything in Greece. Local politicians take advantage of the struggle of the farmers for survival and they use water as a political lever.

It appears that there are not always adequate procedures for providing information to farmers about EU policies and projects. Cases were reported during the interviews (but they cannot be documented with evidence) that EU projects disappeared into the drawers of the Service of Agriculture in order to avoid the extra workload that their implementation would involve. Similarly, the distribution of information and subsidies to individual farmers or groups of farmers according to their political affiliations seems to be the rule.

Under these conditions, when such an example is given from the top, it is unrealistic to expect farmers to adopt an altruistic approach and put their environmental concerns before their short-term survival.

9.13 Training of the specialists -transparency in appointments

The absence of an "education for life" approach is evident in Greece and the Argolid is not an exception to this. As was widely mentioned in the interviews for Archaeomedes, also from the interviewed owners of greenhouses there is an absence of "specialised experts" in Greece. This is confirmed by the fact that in the latter case the owners had started and continued their business with the help of foreign specialists. Equally, they are kept up to date by attending seminars abroad.

Also, apparently due to lack of funds, there are very few seminars organised for the further education and information of the agronomists. The latter cannot be expected to have the time or the motivation to educate themselves with the poor salaries they get and with the administrative load they are charged with. It is required that the role of the agronomists is redefined. The current situation is unacceptable. Scientists with a degree in agriculture are often used for clerical administrative tasks. The public sector in Greece has been accused of suffering from an excess of personnel. Nevertheless, the situation presented is that indeed in some cases there is excess of personnel, hired with rousfeti procedures usually as part of the pre-electoral campaign of politicians. Yet, the Service of Agriculture in the Argolid does not belong to this category. The number of personnel instead of increasing has decreased since the staff were indirectly forced to resign due to political pressure. The agronomists currently working are loaded with the responsibility of seven to eight villages each. Similarly, the situation becomes particularly bad during the export period for the oranges, (November to February) when agronomists are responsible for monitoring quality and co-ordinating exports.

9.14 Need for the agents concerned to agree on a common agenda-need for transparency in research

The approach adopted by policies regarding crop choice is usually top-down and does not account for local situations. The fact that many crops have been suggested and not at all adopted by the farmer is an indication for this (see Section 5.5). However, there is a requirement for a more bottom-up approach which allows the voice of all the interested parts to be heard. For this to happen, there is a need for transparent procedures in research, administration and politics and when farmers are the final recipients of policies regarding crop choice the policy-maker should seriously consider their point of view. Equally, research done should have farmers in mind and be undertaken in collaboration with them. Examples of lack of collaboration from the part of farmers were reported as in the example of their denial to give their wells for replenishment. However, it was understood that the farmers have arguments for their lack of trust towards policy-makers, politicians, agronomists and research institutions: they have been deceived several times by political promises which were not fulfilled, by policies which did not really consider their needs and by research about which they know nothing. Regarding research undertaken in Greece, it was found that there is a lack of collaboration between the various research organisations. On the one hand there are organisations which work on very similar issues but do not cooperate and the other, from research undertaken over a period of years, little information is made available. It seems that the research organisations report to the political institutions which provide them with funding and very few of their results come out in any form: publications, workshops and seminars etc. Research should preserve its autonomy and should not stay with politicians and academics. In particular research which is meant to affect farmers' livelihood should be undertaken in collaboration with them.

9.15 Suggestions for further research

It would be useful if the framework produced in this thesis could be tested and used for assessing the sustainability of more than one crop, for the (Argolid) and elsewhere. As was discussed in Section 5.7, monoculture is a factor reducing the sustainability of an area, therefore when discussing sustainable crop options for the area, this should take the form of a range of crops and not a single crop. On the other hand, within the context of the Argolid, as was extensively discussed in Sections 5.8 and 9.5, the area might require the adoption of zoning policy when suggesting cropping options.

A more practical product of the framework could take the form of a range of crops which promote economic and financial sustainability and another one of crops which would promote ecological and agronomic sustainability. A useful contribution therefore could be a list of those crops which promote both types of sustainability at the same time.

References

Allen, P.M.A et. al. (1994). *Agricultural production and water quality in the Argolid Valley, Greece: a policy relevant study in integrated method.* In: The Archaeomedes Project (EV5V-0021). Understanding the natural and anthropogenic causes of soil degradation and desrtification in the MEDITERRANEAN BASIN. Report to the EU, Brussels.

Altieri, M.A. (1987). *Agroecology: the scientific basis of alternative agriculture.* Westview Press.

Altieri, M.A. (1992) Agroecological foundations of alternative agriculture in California. Agriculture, Ecosystems and Environment, 39 23-53.

Anderson, J.R. (1970). *A Geography of Agriculture.* Dubuque, Iowa, WMC Brown Co.,

Argolid Association of Agronomists, (Hemerida, 1992). The water problem of the Argolid. seminar proceedings (In Greek).

Ashby, A.W. (1926). Human motives in farming. Welsh Journal of Agricultural Science. Vol. 19, 99-106.

Asthana, V.K. (1968). *Land forms and settlements in Almora and its environs.* Phd thesis, Banaras Hindu University, pp83 and 190.

Ayers, R. S. and Westcot, D. W. (1976). *Water quality for agriculture.* Food and Agricultural Organisation of the United Nations.

Barrett G. (1992). *Landscape Ecology: Designing Sustainable Agricultural Landscapes.*

Baum,W.C. and Tolbert,S.M., (1985), *Investing in Development: Lessons of World Bank Experience.* Oxford University Press, London, pp81-117.

Bernstein,L. (1965). Salt tolerance of plants. USDA Agric. Inf. Bull.292.8p.

Blaikie, P. M. (1978). The theory of the spatial diffusion of innovations: a spatial cul-de sac. Progress in Human Geography. Vol. 2, 268-95.

Bournakas, B. (1990) Growing roses in greenhouse: conditions for a good function of agreenhouse unit. In Yeorgiki Technologia, Volume 4,.(In Greek).

Boussard,J.M. (1979). Risk and uncertainty in programming models: a review in J.A. Roumasset, J.M. Boussard, andI. Singh (eds), *Risk, uncertainty and agricultural development*. Agricultural Development Council, New York.

Bowler, I.R. (1975). Factors affecting the trend to enterprise specialisation in agriculture: a case study in Wales. Cambria, Vol.2, 100-11.

Brady, N.C.(1974). *The nature and properties of soils*. 8th Ed. MacMillan, New York.

Brown, B.J. et al. (1988). "Global sustainability: toward definition". Environmental Management Vol 11 No 6 713-719.

Brown, L.A. (1981). *Innovation diffusion: a new perspective*. Methuen. London.

Brown, M.A. (1981). Behavioural approaches to the geographic study of innovation diffusion: problems and prospects. In Cox, K. and Gulledge, r., *Behavioural, problems in geography revisted.* (Methuen, New York).

Bunch.R., (1982). *Two Ears of Corn: A Guide to People-Centered Agricultural Improvement.* World Neighbors, Oklahoma City, 250pp.

Cantor, L, M. (1967). *A World Geography of Irrigation.* London, Oliver and Boyd, pp 5,40 and 102.

Carson,R. (1964). *The Silent Spring*. New York: Fawcett.

Castri di F. and Mooney H.A. *Mediterranean type ecosystems Origin and Structure.* 1973.

CEC: *Perspectives of the CAP: the Green Paper of the Commission*. July 1985, p13).

Chambers,R. (1983). *Rural development: Putting the last first.* London, Longman.

Chambers,R. and B.P.Ghidyal.(1985). Agricultural research for resource-poor farmers: the farmer first and last. Agricultural Admin., 20: 1-30.

Chambers,R., et al.,. (1989). *Farmer First: farmer Innovation and Agricultural Research.* Intermediate Technology Publications, London, 218pp/

Clay, J.W. (1988). *Indigenous Peoples and Tropical Forests: Models of Land-use and Management from L:atin America. Cultural Survival*. Cambridge, MA, 116 pp.

Colfer,C.J.P., Gill,D. and Agus,F. (1988). An indigenous agroforestry model from West Sumatra: A source of insight for scientists. Agricultural Systems, 26: 191-209.

Conway, G.R. (1987). the properies of agroecosystems. Agricultural systems, vol. 24, 95-117.

Conway, G.R., 1985. Agroecosystem analysis. Agricultural Administration, 20:31-55.

Conway,G.R. and Barbier, E.B. (1990). *After the Green Revolution :Sustainable agriculture for Development.* Eartscan publications, London.

Corley, R.H. V. (1989), Assessment of new crops for plantations. In *"New Crops for Industry"*, G.E. Wickens et al.(Editors). Chapman and Hall publications.

Dalsgaard, J.P.T. et al. "Towards quantification of ecological sustainability in farming systems analysis". Ecological Engineering 4 (1995) 181-189.

Dalsgraad J.P.G.(1995). Integrating agronomic and economic models for policy analysis at the farm level: the impact of Cap reform in two European regions. Agricultural Systems, vol.48, 163-178.

Damadnez, J. (1975). Climat des cultures protegees: relation entre le climat exterieur et le micro-climat des cultures sous serres. *Phytotronix in agricultural and horticultural research.* Phytotronix III. Bordas, Paris.

Damianos D., Demoussis M. and Kassimis C. (1991). The empirical dimensions of multiple job-holding agriculture in Greece. Sociologia Ruralis. Vol. XXXI-1.)37-47.

De Waal (C.), 1981. *Urban aspirations and rural development in Southern Greece.* PhD thesis, cambridge University.

Donaldson,A.B., Flichman G. and Webster, J.P. (1995). Integrating agronomic and economic models for Policy Analysis at the Farm Level: the Impact of CAP Reform in Two European Regions. Agricultural Systems, 48 163-178.

Douglass, (1984). The meaning of agricultural sustainability. In: Douglass *Agricultural Sustainability in a Changing Word Order.* Westview Press, Boulder, CO, pp 3-29.

Dover,M. and Talbot,L. (1987). *To Feed the Earth-Agro-Ecology for Sustainability in a Changing World Order.* World Resources Institute, 122p.

Drandakis, P. (1928). (Encyclopedia). Volume 1. (In Greek).

Edwards C.A et al. (1993)."The role of agroecology and integrated farming systems in agricultural sustainability". Agriculture, Ecosystems and Environment, vol. 46 99-121.

Efstathiadis, A (1984). *Stihia kataskevis kai exoplismou thermokipion.* N. Kios, Argolida. (In Greek).

Efstathiadis, Th. (1987). *Thermokipia. Stihia kataskevis,litourgias kai kalliergias*. Ekdotiki Agrotehniki. Athens. Greece. (In Greek).

El Titi, A. (1992) “Integrated farming: an ecological farming approach in European Agriculture”. Outlook on Agriculture Vol. 21. No 1, 33-39.

Environment and Pollution, Vol. 5, Nos 2/3,

Faeth. P. (1993). “An economic framework for evaluating agricultural policy and the sustainability of production systems”. Agriculture, Ecosystems and Environment,vol. 46 161-173.

Fairweather,J.R.and Keating,N.C. (1994). Goals and Management styles of New Zeland Farmers.Agricultural Systems, vol. 44 (181-200).

FAO (1994). ECOCROP 1: The adaptability level of the FAO crop environmental requirements database. Version 1.0. 1994.

farmer, B.H. (1960). On not controlling subdivision in paddy lands. Transactions of the Institute of British Geographers. Vol. 28, 225-235.

Feder, G and Onchan, T. (1987). Land ownership and security and farm investment in Thailand. American Journal of Agricultural Economics,vol. 69,(2) 3

Fennel,R. (1987).*The Common Agricultural Policy of the European Community.* University of Oxford. BSP Professional Bookshops.

Flora Butler, C. (1992). “Building Sustainable Agriculture: a new application of farming systems research and extention”. Journal of sustainable agriculture. 37-49.

Flora, C.B. (1986). Values and the agricultural crisis: differential problems, solutions and value constraints. Agriculture and human values, 3(4), 16-23.

Flora,C.B. (1990). Policy issues and agricultural sustainability. In *Sustainable agriculture in temperate zones*. ed.C.A.Francis, C.B.Flora and L.D.King, 1-23. New York: John Wiley and Sons.

Forbes,H.A. (1976). “We have a little of everything: the ecological basis of some agricultural practices in Methana, Trizinia”. Annals of the New York Academy of Sciences, 268, 236-250,. In Diemen,M and Friedl, E editors , Regional variation in mode.

Found,W.C. (1971). *A theoretical approach to rural land-use patterns*. London: Edward Arnold.

Francis, C.A. and Madden, J.P. (1993).“Designing the future: sustainable agriculture in the US. Agriculture Ecosystems and Environment, 46 123-134.
Francis,C.A., and G. Youngberg. (1990). Sustainable agriculture: An overview. In *sustainable agriculture in temperate zones*, ed. C.A. Francis, C.B.Flora and L.D.
French, B.C., King, G.A. and Minami, D.D. (1985). Planting and Removal Relationships for Perennial Crops: An Application to Cling Peaches. American Journal of Agricultural Economics, p 215-222.
Fresco, L. O. and Kroonenberg S.B. (1992).“Time and spatial scales in ecological sustainability” Land Use Policy, Vol 9 No3.
Fujisaka S. (1994). Learning from six reasons why farmers do not adopt innovations intended to improve sustainability of upland agriculture. Agricultural Systems, vol.46, 409-425.
Gasson R. (1973). Goals and values of farmers. Journal of agricultural economics.vol 24, (521-542).
Gasson, R. (1968). Occupations chosen by sons of farmers. journal of Agricultural Economics. Vol. 19, 317-26.
Gasson,R. (1974). “Socioeconomic status and orientation to work: the case of farmers. Sociologia Ruralis, vol 14, 127-141.
Gasson,R. (1988). *The Economics of Part-time Farming.* Longman Scientific and Technical, Essex.
Gasson,R. Occupations chosen by sons of farmers. Journal of Agricultural Economics, vol 19, 317-326.
Giampetro M., Cerretelli G. and Pimentel D. (1992). Energy analysis of agricultural ecosystem management: human return and sustainability. Agriculture, Ecosystems and Environment,vol. 38, 219-244.
Glaeser B. (December 1988). “ A holistic human ecology approach to sustainable agricultural development”. Futures, (671-678).
Glaser,B. (1988). *Environmental policy: The example of the Federal Republic of Germany in the International Context* (Bonn, Friedrich-Ebert-Stiftung).

Glieaaman, S.R. (1990). Quantifying the agroecological component of sustainable agriculture: A goal. In *Agroecology: Researching the ecological basis for sustainable agriculture.* Editor S.R.Gliessman, 366-370. New York:Spring-Verlag.

Grafiadelis, M. (1980). *Sighrona thermokipia.* Gartagani. (In Greek)

Green, S. and Lemon, M. (1996). Perceptual landscapes in agrarian systems: degradation processes in North-Western Epirus and the argolid Valley, Greece. Ecumene, Vol. 3, No2.

Green,C.L. (1989). Opportunities and Requirements for the Development of New Essential Oil, Spice and Plant Extractive Industries. In *New Crops for Food and Industry.* Edited by G.E. Wickens et al. Chapman and Hall, publications.

Grigg, D. B. (1974). *The agricultural systems of the weorld: an evolutionary approach.* Cambridge University Press, Cambridge.

Grove.T.L. and Edwards,C.A. (1993)."Do we need a new developmental paradigm?". Agriculture, Ecosystems and Environment, vol. 46 135-145.

Grzybowski, A.G.S. and Slocombe, D.S. Self-organisation Theories and Environmental Management: The case of South Moresby, Canada. Environmental Management, Vol.12 No 4, 463-478.

Harwood,R.R., (1987). Agroforestry and mixed farming systems. In: A.E. Lugo, J.R. Clark and R.D. Child (Editors) *Ecological Development in the Humid Tropics: Guidelines for Planners.* Winrock International, Morrilton, AR, pp.271-301.

Hautpli,H. et al. (1990). Biotechnology and crop breeding for sustainable agriculture. *In sustainable agricultural systems*, ed. C.A. Edwards, L.Rattan, P.Madden, R.H.

Herzfeld, M., (1992). *The social production of indifference: exploring the roots of western bureaucracy.* Oxford, Berg, 1992.

Hill B. (1993). The "myth" of the family farm: defining the family farm and assessing its importance in the European Community. Journal of Rural Studies. Vol 9, No4, pp 359-370,.

Hitzhusen, F.J. (1993). "land degradation and sustainability of agricultural growth: some economic concepts and evidence from selected developing countries". Agriculture, Ecosystems and Environment, vol.46, 69-79.

Hurst, M.E. (1974). A geography of economic behaviour. Prentice-Hall. London.12

IJC, Research Advisory Board. (1978). *The Ecosystem approach: Scope and Implications of an Ecosystem Approach to Transboundary Problems in the Great Lakes Basin.* Winsdor,.

Ikered, J. E. (1993)."The need for a systems approach to sustainable agriculture". Agriculture, Ecosystems and Environment, vol. 46 147-160.

Ilbery B.W. (1983). Goals and values of hop farmers. In: Transactions of the Institute of British Geographers. 8 (329-341).

Ilbery B.W. (1987). Agricultural decision-making:a behavioural perspective. In Progress in Human Geography, vol. 2 (488-466).

Ilbery, B.W. (1985). Agricultural Geography, a social and economic analysis.Oxford University Press. New York.

Ilbery,B.W. (1983 b) A behavioural analysis of hop farming in Hereford and Worcestershire, Geoforum, vol. 14, 111-123.

Ilbey, B.W. (1975). *Decision-making in farming: a study of some of the factors affecting the agricultural land-use patterns of northeast Oxfordshire.* PhD thesis, University of Wales, Swansea.

Jackson,W., (1980). *New roots for Agriculture.* Friends of the Earth, San Francisco,CA,294pp.

Jeffrey, P. J. (1992). Managing diversity: the strategic planning of long term technology infrastructure. IERC, Cranfield University. PhD thesis.

Jensen, M.E. (1973). Consumptive use of water and irrigation water requirements. Report of Committee on Irrigation Water Requirements. American Society of Civil Engineers, New York.

Jones, G.E. (1975). *Innovation and farmer decision making*. D203 Agriculture, (Open University, Milton Keynes). OU Press.

Jones,G.E. (1963). The diffusion of agricultural innovations. Journal of Agricultural Economics. 15 (387-405).

Kampen,J.m and Krantz, B.A. (1976). *The farming systems research program.* International Crops Research Institute for the Semi-arid Tropics, Hyderabad, India.

Kaplan, S. and B.J.Garrick (1981). On the Quantitative Defnition of Risk. Risk analysis, vol. 1(1):11-27.

Keating,N.C. (1989). Making it in tough times: a profile of the successful farm operation. Paper presented at the Annual Meeting of Women of Unifarm, Red Deer, Alberta.

King R. and Burton S. Structural change in agriculture: the geography of land consolidation. In: Progress in Human Geography, (1983) vol. 7, 471-501.

King, 1-23. New York: John Wiley and Sons.

King, R. (1973). *Land Reform: the Italian experience*. London, Butterworth.

Kirschenmann F. (1991).Fundamental fallacies of building agricultural sustainability. Journal of Soil and Water Conservation, M/J 165-168.

Klaus, G. and Buhr,M. (editors). (1976). *Philosophisches Worterbuch* (Leipzig, Verlag Enzyklopadies, 12th edition, page 443.

Kofiniotou, I. (1892). *History of Argos.* (In Greek). Public Library Danaos of Argos.

Kohnke, H. and A.R. Bertrand. (1959). *Soil Conservation.* New York, Soil Conservation Services.

Koppen,W. (1931). *Outline of Climatology*. Walter de Gryter Co., Berlin.

Kostrowiski,J. (1984). Types of agriculture in Europe: a preliminary outline of the geography of agriculture in developed market economies. Geographia Polonica vol. 50, (132-149).

Krantz, B.A. (1974). Cropping patterns for increasing and stabilising agricultural production in the semi-arid tropics. In International Workshop on Farming Systems. International Crops Research Institute for the Semi-Arid Tropics, Hyderabad, India.

Latesteijn van H.C. (1995). Assessment of future options for land use in the European Community. Ecological Engineering, vol. 4 211-222.

Layton, R.L. (1981) Attitudes of hobby and commercial farmers in the rural-urban fringe of London, Ontario. Cambria, vol. 8, 33-44.

Layton,R.L. (1979), Hobby farming. Geography, vol. 65, 220-3

Lemon, M. and Park, J. (1993). Elicitation of farming agendas in a Complex Environment. In Journal of Rural Studies, Vol.9, No. 4, pp. 405-410,

Lemon, M., Seaton,R, Blatsou, C and Calamaras. (December 1995).N. Agriculture, Policy and environmental degradation: the case of the Argolid Valley. Medit, Year 6, No4.

Lemon, M.: Blatsou,C and Seaton, R. (1994). Environmental degradation and intensive citrus production in the argolid valley, Greece. Paper prepared for the conference: "L'homme et la degradation de l'environment" . XV Rencontres Internationales d'Archeologie et d'Histoire D'Antibes. In: Actes de Rencontres 20-22 Octobre 1994. Edites par Sander van der Leeuw. Editions APDCA-Sophia Antipolis-1995.

Lianos T.P. and Parliarou D. (1986). Farm size structure in Greek agriculture. Euro R. agr. Eco, vol.13 233-248.

Liverman, D.M. et al. (1988)."Global sustainability: towards measurement". Environmental Management, Vol.12, No 2, 133-143.

Lockeretz, W. (1988). Open questions in sustainable agriculture. American Journal of Alternative Agriculture, vol. 3. 174-80.

Lockeretz, W. (1991). Multidisciplinary research and sustainable agriculture. Biological Agriculture and Horticulture, vol. 8, 101-122.

Lowrance,R., et al. (1986). A hierarchical approach to sustainable agriculture. American Journal of Alternative Agriculture,vol. 1, 169-173.

Maas,E.V. and Hoffman,G.J. (1976).*Crop tolerance-Current assessments.* U.S. Salinity Laboratory publication.

Maddala,G.S. (1989). *Limited-Dependent and Qualitative Variables in Econometrics.* New York: Cambridge University Press.

McCown R.L. etal. (1992). Strategies for Sustainable Crop Production In Semi-Arid Africa. Outlook on Agriculture Vol.21, No 1 21-31

Meadley,J. (1989). The Commercial Implications of new crops. *In: New Crops for Food and Industry.* Edited by G.E. Wickens et al. Chapman and Hall, publishers.

Meigs, P. (1953). World distribution of arid and semi-arid humoclimates. in: *Review of Research on Arid Zone Hydrology.* UNESCO. Paris.

Mergos,G. (1987).Evaluation of irrigation projects under uncertainty: a symmetric quadratic programming approach. Water Resources Management, vol. 1, 45-56.

Milham N. (1994). An analysis of farmers' incentives to conserve and degrade the land. Journal of Environmental Management, vol. 40, 51-64.

Miller and G.House, 141-156. Ankeny, IA: Soil and Water Conservation Society.

Monkhouse, F.J. and Wilkinson, H.R. (1967). *Maps and Diagrams.* London, Methuen &Co.

Moore,M.R. etal. (November 1994). Multicrop production decisions in western Irrigated Agriculture: The role of water price. American Journal of Agricultural Economics vol. 76, 859-874.

Morgan,W.B. and Munton,R.J.C. (1971). *Agricultural geography.* London : Methuen.

Munton,R,J.C. (1974), Farming on the urban fringe, in Johnson,J.H. (ed), *Suburban growth - geographical processes at the edge of the western city.* (Wiley,London).

Murdochh, J. (1993). "Sustainable rural development: towards a research agenda". Geoforum Vol 24, No3, 255-241

Nanseki,T. and Morooka,Y. (1991). Risk preference and optimal crop combinations in upland Java,Indonesia: an application of stochastic programming. Agricultural Economics, 5 39-58.

Neher D. (1992.). "Ecological sustainability in agricultural Systems: Definition and Measurement". Journal of sustainable agriculture.

Newbury, P.A.R. (1980). *A Geography of Agriculture.*Longman Scientific and Technical

Nisen, A. (1972). *La pollution des sols en colture protegee.* "P.H.M.", n. 127.

NRC (National Research Council). (1989). *Irrigation Induced Water Quality Problems: what can be learned from the San Joaquin Valley experience.* National Academy Press, Washington, D.C.

ODA. (1983). The Evaluation of Aid Projects and Programmes. Proceedings of a Conference organised by ODA at the Institute of Development Studies, University of Sussex, April 1983.

Olson, R.K. (1992)." The future context of sustainable agriculture: planning for uncertainty. Journal of sustainable agriculture, Vol.3, 9-20.

Olson,R.K. (1992). "Integrating sustainable agriculture, ecology and environmental policy. Journal of sustainable agriculture, Vol. 3, 150-172.

Olsson,R. (1988). Management for success in modern agriculture. European Review of Agricultural Economics, 15 (2/3) 239-259.

Panagiotou A. et al. (1994). Aspects of communication in the farming milieu: results of an empirical research in Greece. Medit No1/94.

Papaioannou,I. (1980). *The water problem of the Argolid.* (In Greek). Anagenissi Press. Source : Library Palamidis in Nafplion, Greece.

Park, J. (1993). Towards a sustainable systems framework: the assessment of silvoarable agroforestry as an innovative cropping practice. PhD thesis. Cranfield University.

Park. J and Seaton, R.A.F. (1996). Integrative research and sustainable agriculture. Agricultural Systems 50 81-100.

Pelt van, M.J.F. (1995)."Environmental sustainability:issues of definition and measurement". International Journal of Environment and Pollution. Vol.5. No2/3.

Perelman,M. (1977). *Farming for profit in a hungry word.* New Jersey: Allanheld, Osmun and Co.Pub.Inc.

Pierece, J.T. Agriculture, sustainability and the |Imperatives of Policy reform, Geoforum, vol. 24 No4 (381-396).

Poincelot,R.P. (1986). *Toward a more sustainable agriculture*. AVI Publishing Company, Inc. Westport, Connecticut.

Pomeroy,A. (1987). The "Rural Crisis" in perspective: family farming in Australia and New Zeland. Paper presented at SAANZ Conference, University of New South Wales, Sydney, Australia.

Redclift M. (1991)."The multiple dimensions of sustainable developmet" Geography, vol. 76 (1) 36-42.

Reg. No.El3124, Circular No.9. (March 1957):(Athens: Ministry of Agriculture, Consolidation of Agricultural Property in Greece).

Richards,L.A. (1954). *Diagnosis and improvement of saline and alkali soils*. U.S. Dep. Agrioc. handb. 60.

Riddell,J.C. (1987).Land tenure and agroforestry: a regional overview. In *Land, Trees and Tenure*. ed.J raintree. ICRAF, Nairobi.

Riton C. and Harvey D. (1991).*The Common agricultural Policy and the World Economy: Essays in Honour of John Ashton.* C.A.B. International.

Rodale,R.. (1983). Breaking new ground: the search for sustainable agriculture. Futurist, vol.17 (1):15-20

Ruiz Perez M. Development of Mediterranean Agriculture: an ecological approach. Changing Agriculture, Changing Landscape. International Conference on the Future of the European Landscape. Rotterdam, 9-11 May, 1988.

Saha A., Love A. and Schwart R. (November 1994). Adoption of emerging technologies under output uncertainty. American Journal of Agricultural Economics, vol. 76, 836-846.

Sakelis, M.G. (1986). An empirical analysis of savings behaviour of the Greek agricultural households. In Euro. R. agr. Eco. Vol.13, 169-188.

Sanderatne, N. (1972). Tenancy in Ceylon paddy lands: the 1958 reform. South Asian Review. Vol. 5, 235-255.

Shaller,N. (1990). Mainstreaming low-input agriculture. Journal of Soil and Water Consrvation., Vol.45, 9-12.

Sideris,A.D. (1934). *Ai georgikai Politikai tis Ellados kata tin Lixasan Ekatontaetian.* Athens: Papadoyiannis. (In Greek).

Singh U. and Thornton,P.K. (1992)."Using crop models for sustainability and environmental quality assessment". Outlook on Agriculture Vol. 21, No3, 209-218,

Singh, J. and Dhilon, S, (1984). *Agricultural Geography.* Tata McGraw-Hill Publishing Company Limited. New Delhi.

Slocombe,D.S. (1990)."Assessing transformation and sustainability in the great Lakes Basin". GeoJournal, Vol. 21,3, 251-272

Smartt,J. (1989). The potential Value of Under-exploited Plants in Soil Conservation and Land Reclamation. In: *New Crops for Food and Industry.* Edited by G.E.Wickens, N.Haq and P.Day. Chapman and Hall, publishers.

Smit B. and Brklacich M. (1989)."Sustainable developmet and the analysis of ryral systems ". Journal of Rural Studies, Vol.5, No4, 405-414.

Spanopoulou K. (1990). Structural weaknesses of Greek Agriculture in the Period 1957-1987: Empirical Analysis and Policy Implications. Journal of Regional Policy, Vol.4/9. 10 519-555.

Spedding, C.R.W. (1979). *An introduction to agricultural systems*. Elsevier Applied science.

Stefanidis, D. (1948).*Agrotiki Politilki, , Gaioktisia kai Gaioktitiki Politiki.* (*Volume I*) Athens, Petsalis. (In Greek).

Stenholm,C.W., and D.B. Waggoner.(1990). Low-input, sustainable agriculture: Myth or method? Journal of Soil Water Conservation, Vol. 45, 13-17.

TAC/CGIAR, Sustainable Agricultural Production: Implications for International Agricultural Research. FAP Research and Technology Paper No4, FAO. Rome, 1989.

Tarrant,J.R. (1974). *Agricultural geography*. Newton Abbot: david and Charles.

Tayler, R.S. (1989). Alternative crops for Europe.In: *New Crops for Food and Industry*. Edited by G.E.Wickens et al. Chapman and Hall, publishers.

Thompson, K. (1963). *Farm fragmentation in Greece*. Athens: Centre for Economic Research. Research Monograph. Series 5.

Thompson,P.B. (1986). the social goals of agriculture. Agriculture and Human Values. 3(4), 32-42.

Thorne, D.W. and Thorne, M.D. (1979). *Soil, Water and Crop Production.* AVI Publishing Company, Westport, Connecticut.

Thornthwaite,C.W. (1948). An approach to a rational classification of climate. Geogr. Rev. Vol. 38, 55-94.

Thornwaite, C.W. (1944). Report of the Committee on transpiration and evaporation. Transaction of the American Geographical Union. Part 5, pp688-693.

Thornwaite, C.W. and F.K. (1965). *The loss of water to the air*. in Agricuiltural Meteorology, Waggoner, P.E. (Eds), No 28, Boston.

Troll, C. (1965). *Seasonal climates of the earth*. In World Maps of Climatology, 2nd Edition. H.E. Landsberg et al. (Editors). Springer-Verlag, New York.

United States Department of Agriculture. (1951). soil Survey Manual. Washington.

University of California Committee of Consultants.(1974). Guidelines for interpretation of water quality for agriculture.13p.

Vallentyne, John R.; Beeton,Alfred.M. (1988).: The "Ecosystem" approach to mananging human uses and abuses of natural resources in the Great Lakes Basin. Environmental Conservation, Vol. 15,1,58-62.

Van de Ploeg, J.D. (1985). Patterns of farming logic, structuration of labour and impact of externalisation: changing dairy farming in Nothern Italy. Sociologia Ruralis, vol. 25, (3/4), 5-25.

Van Otten, G. (1980), Changing spatial characteristics of Willamette valley farms. Professional Geographer, vol. 32, 63-71.

Vita-Finzi, C.(1969). *The Mediterranean Valleys: geological changes in historical times.* Cambridge, at the University Press.

Wallace, A. (1976). *Influence of salty soils on citrus trees in Greece*. Project (76)05. Organisation for Economic Cooperation and Development. Technical Cooperation Service. CT/1180.

Waugh, D. (1995). *Geography: an integrated approach.* Thomas Nelson and Sons Ltd. Second Edition.

Williams, J.T. (1989). Plant introduction and international responsibilities, In: *New Crops for Industry.* by G.E. Wickens et al. Chapman and Hall Ltd.

Wolpert,J. (1964): The decision-making process in a spatial context. Annals of the Association of American Geographers. 54, 537-558.

Word Commission on Environment and Development. (1987).*Our Common Future.* Oxford University Press, Oxford, UK.

Yeorgiki Technologia (1988). Roses: they can be financially profitable through exports. An interview with Mr. I. Grogoriou (farmer-exporter). Vol. 10-December 1988. (In Greek).

Yulong C. and Smit B. (1994). Sustainability in Chinese agriculture: challenge and hope. Agriculture, Ecosystems and Environment. vol. 49, 279-288.

Yunlong C. and Smit B. (1994). Sustainability in agriculture: a general review. Agriculture, Ecosystems and Environment, vol. 49, 299-307.

Zeginis,G. *History of Argos*. (1967). In Greek. Source: Library Palamidis in Nafplion, Greece.